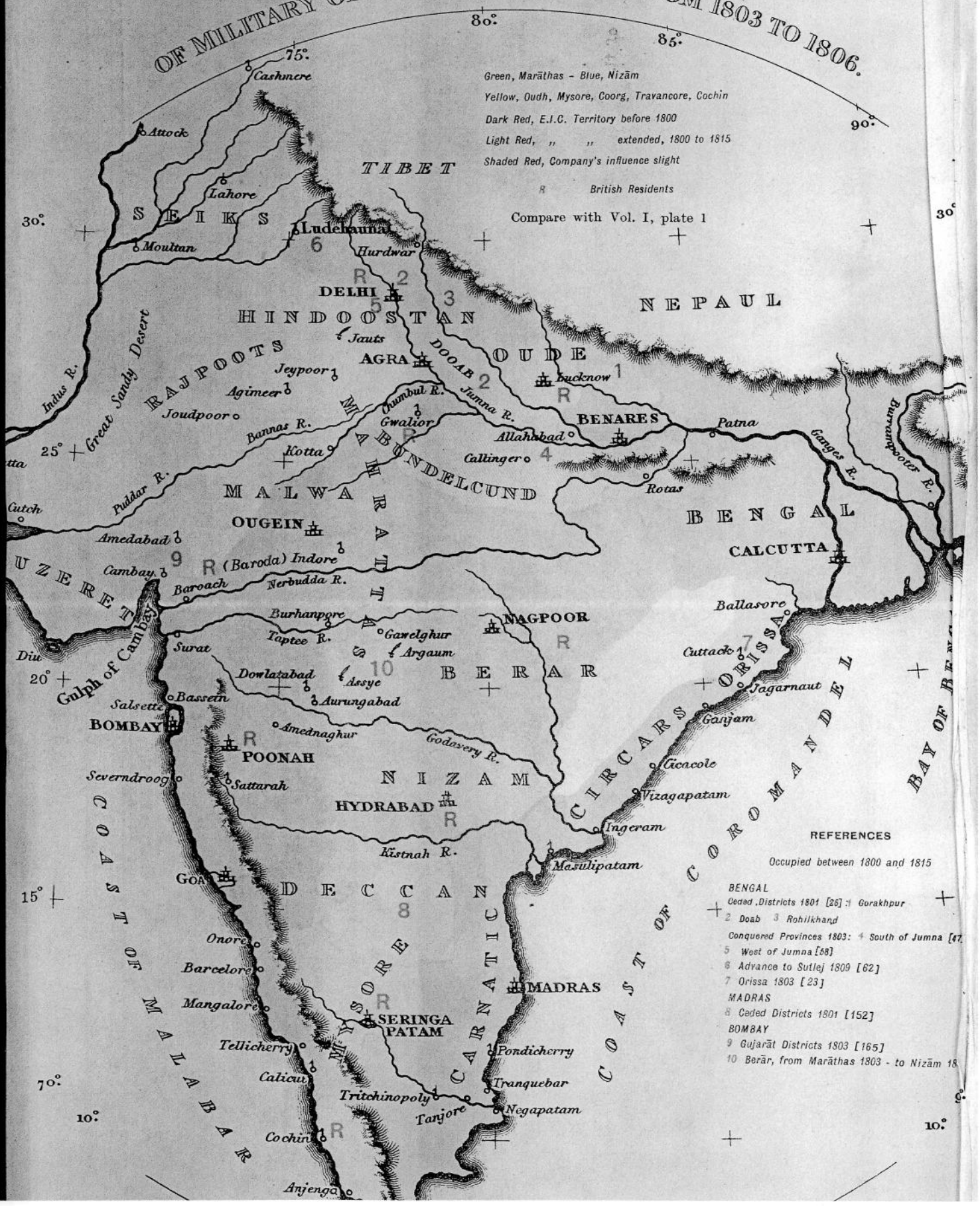
Geographical Sketch,

OF MILITARY OPERATIONS IN INDIA FROM 1803 TO 1806.

Green, Marāthas - Blue, Nizām
Yellow, Oudh, Mysore, Coorg, Travancore, Cochin
Dark Red, E.I.C. Territory before 1800
Light Red, ,, ,, extended, 1800 to 1815
Shaded Red, Company's influence slight
R British Residents

Compare with Vol. I, plate 1



REFERENCES

Occupied between 1800 and 1815

BENGAL
Ceded Districts 1801 [26]: 1 Gorakhpur
2 Doab 3 Rohilkhand
Conquered Provinces 1803: 4 South of Jumna [47]
5 West of Jumna [58]
6 Advance to Sutlej 1809 [62]
7 Orissa 1803 [23]
MADRAS
8 Ceded Districts 1801 [152]
BOMBAY
9 Gujarāt Districts 1803 [165]
10 Berār, from Marāthas 1803 - to Nizām 18

Plate 1



15°

70°

HISTORICAL RECORDS OF THE SURVEY OF INDIA 1800 to 1815

Plate 1

526.9
P54
Vol. 2

fQB
296
I46
v.2

VOLUME I 18th Century Published 1945.

VOLUME III 1815–30 In Press.

VOLUME IV 1830–43 Under preparation.

Published 1950

PRINTED IN INDIA

SOUTH ASIA

The map overleaf is a reconstruction embodying the main particulars of Ptolemy's maps as shewn in A.D. 1410.

Ptolemy's atlas of the spherical world, containing maps drawn on a crude globular projection, was completed about A.D. 160, and Greek MS. copies, with many alterations and additions, were brought from Constantinople to Florence about A.D. 1400.

One version, containing a map of the world and 26 maps of countries, was translated into Latin. and redrawn about 1406. Numerous MS. copies were made, and in 1477 a set was engraved and published at Bologna.

Subsequent editions, of which there are at least fifty, differ greatly in style, but one of the clearest and most pleasing is that published at Rome in 1508. In this there are several additional maps, and all are drawn on a pseudo-conical projection with two standard parallels. A copy of this is in the British Museum (Maps-C.1.d.6).

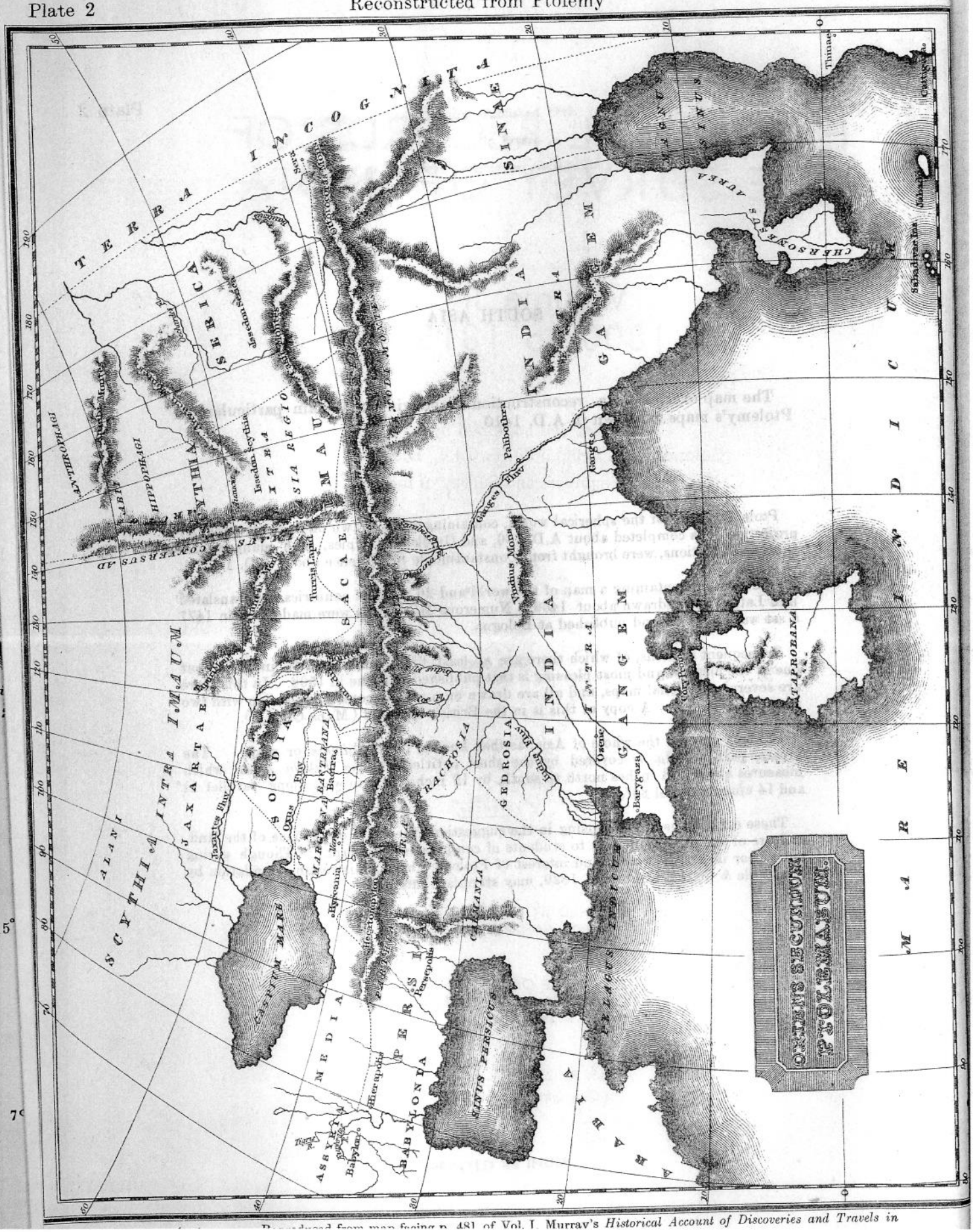
Ptolemy covered the whole of Asia, as then known, in 12 *Tabulae* or maps. The greater part of India is covered by the sheet entitled *Decima Tabula Asiae*, which measures about 13½ inches north to south, by 19 inches east to west along parallel 11° and 14 along parallel 39°.

These early maps are surprising in the suggestions they give of the face of the land, and are of the utmost interest to students of comparative geography. Though giving but a poor idea of the wealth and interest of Ptolemy's atlas, this rough compilation by Constable & Co. of Edinburgh, 1820, may stimulate interest.

SOUTH ASIA

Plate 2

Reconstructed from Ptolemy



Reproduced from map facing p. 481 of Vol. I. Murray's *Historical Account of Discoveries and Travels in*

HISTORICAL RECORDS OF THE SURVEY OF INDIA

Volume II
1800 to 1815

Collected and compiled by
Colonel R. H. PHILLIMORE, C.I.E., D.S.O.,
(late Royal Engineers and Survey of India)



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1950

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TRIGONOMETRICAL SURVEY

A concatenated series of Triangles...was to be preferred to every other mode, not only as the most exact of any, but as a method which...absolutely precludes the necessity of every other, being founded upon Geometrical certainty and truth.

Were these Triangles carried throughout India, ... the Geography of the Company's Territories might soon be rendered compleat. ... *One good Geometrical* survey of a Province, or line of coast, is sufficient, whereas after *ten bad ones* the work requires to be gone over again [I, 190].

MICHAEL TOPPING. 26th Dec. 1791.

What I am most anxious for at present is that this survey should preceed all others, that data may be ready prepared, and the work become the legitimate foundation of every other survey, whether geographical, military, or statistical [245].

WILLIAM LAMBTON. 28th Jan. 1811.

ADMINISTRATION

I conceive that the union of the Survey Departments under the controul and management of some able and scientific officer would produce an unity of system, and diminuation of expence, greatly to the benefit of the service [298].

GEORGE HEWETT. 27th Aug. 1810.

I hope...that I may be still of some use if I can be in any way instrumental in bringing these intended works to one uniform system [424].

COLIN MACKENZIE. 19th Oct. 1810.

HISTORY

There is also a great need in the Department for a full and clear chronological history of topographical, and of revenue, surveys, province by province. The only extant works we have on the subject...are mere outlines, and only deal with the subject in a general and perfunctory way, and are of very little practical use...as books of reference, whilst they are deficient of information of vital importance. I venture to think that had such a history been available, the labours of the present Committee would have been considerably facilitated.

J. R. HOBDAY. Offg. Surveyor General.

Selected Evidence; *Indian Survey Committee. 1904–5* Part II; Sec. III. p. 86.

Addenda & Corrigenda to Vol. I

Supplementary to lists on pp. vi and 305 of that volume.

Plate 1 The districts of *BERAR, Jafferabad* to *Omrautty*, should be tinted green. They were ceded to the Nizām by Nāgpur in 1804.

Page vi against page xx *omit this entry*
" 73 2nd line, *for* 4 *read* 5.
" 194 *omit* s *at end of* Montogomeries
" 223 line 4, omit *delete* Ben. Civ.

x line 11 from bottom, for *Lives* read *List*.

xi line 4, *for* OF *read* TO.

xvii against *Addiscombe*, for *Heroes* read *Heros*.
above *Ben Sel.* insert
Ben Regr. A Register of Maps...of the Bengal Presidency. Survey Committee. 2 vols. Calcutta. 1838.
for Blochman *read* Blochmann *in two places.*
above Bowring *insert*:—
Bolts. *Considerations on Indian Affairs.* Wm. Bolts. London. 1772.
against Cardew, *line 2, before* Cardew *insert* H. G.
against *Clan Campbell*, for *H.I.E.C.* read *H.E.I.C.*
against Clements Markham, *after* Bogle, *for* of *read* to.
against Cotton, line 2, *before* Cotton *insert* J. J.
against Crawford's *List* for *List of Officers* read *Roll* and after *IMS.* insert *1615–1930.*
against Crawfurd, line 2, *before* London *insert* 2 vols.
below Crawfurd *insert* :—
Crofton I *List of Inscriptions...in the Central Provinces & Berar*, O. S. Crofton. Nagpur. 1932.
Crofton II *List of Inscriptions...in H. H. the Nizam's Dominions*, O. S. Crofton. Hyderabad. 1941.

xviii *above* Fay, *insert*
Fawcett *English Factories in India, 1670–77.* Sir Charles Fawcett. Oxford. 1939.
below Foster *insert*:—
Foster II *Descriptive Catalogue of the Paintings... in the India Office.* Wm. Foster. 5th edn. 1924.
below Fullarton *insert*:—
G M. *Gentleman's Magazine* (periodical).
against Gurwood, line 2, *before* Gurwood *insert* Lt Col. John *and after* Gurwood *add* 12 vols. & index. London. 1840.
Hobson Jobson ; insert hyphen between these words.
below Hodson *insert*:—
Holwell *Interesting Historical Events...*J. Z. Holwell. 1765. 2nd edn. 1766. London.
against *Imp Gaz. for* Calcutta *read* Oxford *and after* 1907–9 *insert* 23 vols.

xix *against* Markham, line 2, *for* 1773 *read* 1873.
above Noti *insert*
Nagpur Territories Early European Travellers in the Nagpur Territories. repr. from old records. Nagpur. 1930.
above O'Malley *insert*:—
Oldham *Historical & Statistical Memoir of the Ghazeepoor District & Benares Province...to 1795.* Wilton Oldham. Allahabad. 1876.
against Ousely, *line 2, for* W. *read* Wm.

xx *against* Stewart, *line 2, before Phil. Trans., insert* by John Stewart, FRS.
for Swetenham, *in two places, read* Swettenham. After *Malaya, insert* Sir Frank A.

1 line 16 from bottom, *for* with *read* after, *and for* 1749 *read* 1742.

15 line 18, *for* 000 *read* 256.

Page 16 at end of note 8 *add* Ritchie's maps, MRIO. 100 (27, 31); 101 (19, 20, 35–7).

23 line 16 from bottom, *for* Comila *read* Comilla.

24 note 7, *after* Hindus *insert* cf. *Imp Gaz.* XV (21).

31 note 7, *for* 17-77 *read* 1777.
note 9, *before* BM. *insert* original journal; *after* 29213 *insert* copy DDn. 162, M 243 ; *at end of note, after* 389 *add* route entered by hand on MRIO. 94 (16), Thos. Jefferys' engraved map [211].

34 at end of line 9 from bottom, *after* others *insert* [269].

35 at end of note 8 *add ;* Oldham, I (109–17).

39 line 24, after Farquhar *insert ref. to new note to read*—
b. 28–2–55 ; son of Robt. Farquhar, and bro. to Sir Walter, a London physician ; uncle to Robt. Townsend Farquhar, Bart., a director of EIC. 1826–8. Crofton, I (109–10).
line 2 from bottom, *between* Mr. *and* White *insert* J.
note 3, *after* 118 (5) *insert*, Misc. 4–0–1779, at end of note 8 *insert* Crofton, I (112).
note 9, *for* 1785 *read* 1783–6.
note 12, *before* near Sārangarh *insert* at Semra, *and after* Farquhar d. *insert* at Mohra.

40 note 1, *for* 1870 *read* 1930 ; cf.
note 3, *before* Etawah *insert* MRIO. 81 [22–4];

42 under Political Missions, at end of line 10, *after* Cossids *insert* [286].

45 To section heading, coasts of the bay of bengal, *insert ref. to new note, to read,* cf. brief summary *Progs. of Indian Historical Records Comn.*, XXIV (52).

46 note 8, *for* Swetenham *read* Swettenham *and at end of note add* Light arrd. India 1783 in comd. of *Blake ;* Hickey, III (50).

47 line 14, *after* compleated *insert ref. to new note, to read* MRIO. 104 (30); *Plan of Part of the Island of Pulo Penang*, with soundings, $1\frac{3}{4}$ m. to an inch ; may be Kyd's map, or that of Topping, 1790 [390].

48 line 3 from bottom, *after* Island *insert ref. to new note*, to read—
Map, Nicobar Is. Jan. 1790, longitude by Colebrooke and Kyd, MRIO. 106 (2).
at end of note 4, *insert* Hickey, III (361–2).
at end of note 5 *insert ;* Maps, MRIO. 100 (5–6).

49 notes, line 5, *after* 116 (31), *insert ;* MRIO. 102 (1–3) ; 104 (18–23, 44–5).

50 at end of 5th para from bottom, *after* of the river. *add* In 1785 he published engraved charts of Hooghly and Balasore rivers and, about the same time, other charts of the northern shores of the Bay of Bengal from surveys by Plaisted and Ritchie. *with ref. to new note* to read, *Ben Regr.* 548 (85–6) ; 550 (96).
Before para beginning From 1779, *insert the second para on p. 52,* There is at Calcutta... Parrott's death in 1772.

51 at end of line 12, *after* charts *change stop to comma, and add* and in 1803 granted pension equal to full pay, Rs. 120 *pm.*
at end of note 7 *insert ;* VM. exbt. 1786, a copy.
note 8, *before* MS. copy *insert* MRIO. 43 (1);
at end of note 12, *for* Bio. Notes *sv.* Martin *read* p. 353.

71866

Addenda & Corrigenda, Vol. I

Page 52 para 2, There is at Calcutta...in 1772 *to be moved to p. 50, as indicated above.*
note 1, *after* 15 *insert,* 16.
53 after line 11 *which ends* by 1786. *insert* new para., type 11;
Still preserved in 1947 is a sheet of nine tables of levels, obviously by Wood, entitled "Levels carried from the Bank of the Hughly River in different parts of the Town of Calcutta towards the Marratoe Ditch & Salt Water Lake in the years 1783 & 1784". They contain reference to "gardens" belonging to Mr. Francis and Col. Hampton. Tables 8 and 9 were "taken by me betwixt the Months of July & Septr. 1774". *with ref. to new note to read* MRIO. 52 (14).
note 6, *for* 43 (4) *read* 43 (4, 5); original to VM.;
54 above notes insert new para., type 11; *to read—*
In 1786 Thomas Call prepared a general map of Calcutta and surrounding country on scale 2 inches to a mile, extending about five miles to north and east, and from 10 to 14 miles south and west of Fort William. *with ref. to new note 6 to read* Copy MRIO. 43 (7); original to VM. in 1924; copies printed at SGO. 1918.
56 at end of note 8 *insert;* Misc. 1–O–1795.
at end of note 12 *insert* Map of Ujjain & vicinity, shewing in heart of city "House where the observations were made", with date 14–4–1792; MRIO. 187 (20, 21).
at end of note 14 *insert* Map of Bhopāl, 3–4–1792, MRIO. 187 (22, 23).
58 at end of note 4; *insert;* Route surveys, MRIO. 31 (27, 71, 77–80), beautifully drawn.
59 *under* Chittagong Frontier, 1794 *line 2, after* Chittagong, *delete* under instructions...commanding. *and substitute* with the force sent to deal with Burmese incursions from Arakan.
60 note 9, *for* Mārtin *read* Mātin.
note 12, *for* 000 *read* 29.
62 at end of line 11 from bottom, *after* information *insert ref. to new note, to read* Original fdbk. MRIO. M 264; maps, ib. 25 (58–68).
65 line 6, *after* river, *insert* [229].
at end of note 4, *insert* MRIO. 43 (13).
note 5, *for* expence *read* expense.
66 note 5, *after* MRIO. *insert* 101 (8, 9);
71 note 5, *for* george *read* gorge; *for* Rikikesh *read* Rikhikesh.
note 8, *after* Mogul" *insert,* Jehangir, from court of James I; first audience at Ajmer, Jan. 1616.
73 note 4, *for* Glascow *read* Glasgow.
74 *for line 17 from bottom,* Stewart's...reports, *read* An interesting account of Tibet by John Stewart, a member of Bogle's mission *at end of note 13 add;* Murray, II (446–67).
75 under Nepāl, lines 11 and 12, *for* Raja of Gorkha *read* Gurkhas, *adding ref. to new note to* read *Imp Gaz.* XIX (33).
line 15 from bottom, *after* Gurkhas *insert,* who had now become masters of the whole country, *for* war against Tibet *read* dispute with China.
77 at end of note 15 *insert;* Murray, II (385–91).
80 under Welsh's Expedition, line 3, *after* Bengal *insert ref. to new note,* to read *Imp Gaz.* VI (31–2).
81 at end of line 5, *after* defeated *insert ref. to new note to read* MRIO. Misc. 1–O–1794, a beautiful little sketch shewing defence of Gauhāti, Nov.–Dec. 1792.

Page 82 line 20 from bottom, *for* propor-tional *read* proportional.
83 at end of note 11 *insert;* MRIO. 156 (18); 176 (18), Capt. Palairet survd. Tavoy R., 1753.
92 at end of note 5, *insert;* Maps MRIO. 146 (6, 25, 26).
at end of note 12, *insert;* see MRIO. 140 (21).
93 at end of note 3, *insert;* see also MRIO. 133 (34); 134 (17, 18).
at end of note 12 insert; *RE. Journal,* LVIII (5).
94 note 12, *after* MSS. *insert* LXVIII;
99 note 2, delete, *Memoir* 1793 (25).
at end of line 16, *after* Bourzet's map *insert ref. to new note to read—*
M. de Bourcet (*sic*) arrd. Pondicherry *c.* 1767, deputed to restore its fortifications. *Archives Anciennes* I (230–7).
100 line 5, *after* sketch *insert ref.* 3, *and in note 2, before* DDn. 246 (142) *insert ref. number* 3.
103 at end of note 9 *insert;* MRIO. 101 (17).
104 note 2, for *Mad* I (365) *read* VI (3).
110 note 13, *for* MRIO. *read* GBO Lib. Aa–42.
at end of note 14 *insert;* MRIO. 133 (51) shows Tipu's camp on Bhavani R., north of Coimbatore.
111 line 2 from bottom, *for* Ellington *read* Eidington.
note 5, *for* 138/40 *read* 138 (49, 50).
112 at end of note 7, *insert;* MRIO. 136 (16, 17).
note 12, *delete* 134 *and after* etc. *insert* ; GBO. Lib. Aa–45. M 134.
note 13, *for* (3) etc. *read* (3–41); sheet 29 carries magnificent pen-and-ink title-piece.
114 at end of note 1, *insert;* Map, scale 5 m. to inch, 146 (2, 3), with ref. to Goldingham's letter of 30–3–1800.
117 at end of note 7, *add;* Mackenzie's collection of routes in Deccan, 1792–8, MRIO. 64, A,B,C.
123 under Marine Surveys, at end of 3rd para., *after* town sites. *insert—*
There is a French map of Mahè taken by "Mr. le fèvre, Enseigne, ... par ordre de Monsr. Belcombe, Maréchal de Camp, ... Gouverneur de Pondicherry". *with ref. to new note,* to read MRIO. Misc. 1–O–1778.
at end of note 13 *insert* John Ringrose, bapt. Bombay, 1757; son of Thos. & Julian Ringrose; Volr. 1772; 1st Lieut. 1784; 1791, omitted.
124 in front of note 1, *insert* 1—*at end insert;* Plan of Harbour, MRIO. 101 (25).
at end of note 3, *insert* Survey of Laccadive Is. by John Wedgborough, 1795; MRIO. 102 (30); Markham (5–6).
127 note 2, *for* ib. *read* Bo S & Pol.
131 note 11 *for* 144 *read* 146.
at end of note 14, *insert* ; Map drawn by Chas. Hempel [*sic*] 7 m. to inch; MRIO. 146 (37).
132 at end of note 2, *insert* ; MRIO. 146 (35), Sketch of Malabar, Moncrieff, 1793, 8 m. to inch; ib. 134 (8), Canara, 8 m. to inch, by Moncrieff, drawn by Williams, with route to Seringapatam, probably 1799–1800.
133 note 3, *for* Blochman *read* Blochmann.
136 line 25, at end of para, *after* lacs *insert ref. to new note, to read* Smyth; cf. Holwell (217–8).
143 at end of note 8, *insert* ; portrait, VM. exbt. 1112.
145 at end of note 1, *insert* ; Map, with table of revenues, MRIO. 146 (4).
147 under Bombay, line 2, *for* a Mr. Herman Blake, *read* Herman Bake, a German adventurer.

Addenda & Corrigenda, Vol. I

Page 147 line 3, *for* spending several months on *read* made.
line 4, *omit* which illness...completing.
lines 5 and 6, *for* but nothing...followed *read*— That of 1710 was carried out by Captain Euclid Baker, with the assistance of Ensign John Burnell. *with ref. to note* 4.
lines 6 and 7 from bottom, *for* assitance *read* assistance, *and for* Cadet Whiteman *read* Charles Wittmann.
for last 3 lines from is possible...connection [120], *read* was probably completed by Major David Speath, one of the German officers brought out about 1769. *with ref. to new note, to read*—
Bom. Dist Gaz. XXVI, part II (420 n.); Speath d. of wounds received at storming of Ahmadābād, Aug. 1780.
note 3, *delete* elsewhere...Bake. *and after* I (20) *insert ;* Fawcett (77–110).
at end of note 4, insert *Bombay in the days of Queen Anne* (xxvi n.23); *Hakluyt Soc* II. vol. lxxii.
148 line 4, *for* left *read* compiled.
152 note 1, *for* ib. *read* La Touche.
163 line 20, *for* Burrrow *read* Burrow.
165 note 1,—line 2, *for* & *read* and—line 3, *after* RMC. *enter* Marlow.
note 2, *after* Yorkshire ; *insert* FRS. and Copley medal ;
at end of note 2, *insert* ; another pub. as pl. iii, p. 228, *Emp. Svy. Rev.* 52. VII. April 1944 ; see also pp. 9 to 15, *Handbook of Scientific Instrument Manufacturers' Association of Great Britain.*
166 para. 5 from bottom, line 1, *for* A Large *read* The large *and for* E.I.C. *read* E.I. Company.
note 4, *for* (20) *read* (20–1).
171 line 15, *after* Stancliffe *insert ref. to new note, to read* John Stancliffe, foreman to Jesse Ramsden [165 n.2].
173 at end of note 4, *insert* ; Sandes, II (190).
176 at end of note 6, *insert* ; Murray, II (173–82).
180 at end of para 4 from bottom, *after* Calcutta, *insert ref. to new note to read* B Pol C. 163/1800 (395–435), 10–7–1800.
at end of note 3, *add* ; on return to France, Le Gentil found that he had been adjudged legally dead, and his property distributed to next-of-kin ; *Nature* 153 (184), 12–2–1944.
193 lines 7 and 8, *for last sentence* It is a great... early life. *read* It would be interesting to learn something of his early education.
at end of note 5 *insert* ; map, 2 geo. m. to inch, MRO. 116.
197 note 1, *for* MMC. *read* BMC.
199 note 1, *for* Symth *read* Smyth.
201 under Theodolites, line 7, *after* maker *insert ref. to new note, to read*—
b. 1753 ; son of John Troughton (d. 1784) ; FRS. and Copley medal ; d. 1835 ; *DNB.*
204 in para 8, line 7, *after* E. E. Pote *insert ref. to new note, to read*—
ed. Eton 1768 ; BCS ; son of Joseph Pote, Eton bookseller ; bought part of Polier's collection of mss., which he presented to Eton Coll. and King's Coll., Oxon.
at end of note 3, *insert* ; an orrery is a form of planetarium run by clockwork, named after Charles Boyle (1676–1731), 4th Earl of Orrery (*DNB*), for whom such instrument was made.
207 at end of note 6, *add* ; Ptolemy.
211 at end of note 6, *add* MRIO. 94 (14–7).

Page 216 at end of line 12 from bottom, *after* has been compiled *insert ref. to new note to read.*
MRIO. 94 (47) ; Index, scale 200 m. to inch, taken from Rennell's small map of 1788 [pls. 1, 21], shewing lay-out of 12 sheets of Call's atlas, with list of authorities, which includes ; Gwalior to Jaipur, Rev. Mr. Mackinnon—Poona to Rajahmundry, Col. Macpherson—Nagpur to Hyderabad, J. Laird, in company with R. Johnson, Esq.—routes communicated by J. Grant Esq.
217, 219 ; Section Heading, *for* Reynold's *read* Reynolds'.
221 at end of note 3, *insert* MRIO. 52 (42, 42*a*).
223 note 10, *after* Bolts ; *insert* of Dutch birth.
224 lines 7 and 8 from bottom, *for* an index *read* indexes *and after* sheets *delete comma and substitute* and
225 at end of note *add* ; There are now several copies of ms. 5-mile maps by Rennell amongst MRIO. collection and folios 53, 59 (41–7).
227 at end of note 4, *insert* ; MRIO. 96 (19), original compilation of Oudh—Delhi map, 24 m. to inch, dated 1775, apparently in Rennell's own hand.
at end of note 5, *insert* ; MRIO. 52 (26, 27); Misc. 13–O–30.
228 at end of footnote 3, *insert* ; MRIO. folio 54.
229 line 5 from bottom, *after* when *insert* they were superseded by *and for* began to appear. These *read* which.
at end of note 1, *insert* ; Maj. Thos. Adams (1730 ?–64), HM. 37th Foot ; Ens. 1747 ; *DNB.*
230 at beginning of note 5, *insert* MRIO. 94 (10), scale 24 m. to an inch.
232 note 2, *for* (6) *read* (6, 7).
at end of note 4, *insert* ; Murray, II (183–202).
233 note 7, *delete* 4 (525) *and for* etc. *read*, 31.
at end of note 13, *insert* ; Murray, II (438–40).
234 note 2, *for* (11) *read* (11, 12).
244 at end of note 7, *insert* ; Other maps of this period ; MRIO. 134 (11), Coromandel Coast, from Ganjam to south, including Ceylon ; 20 m. to inch ; shows military stations ; very vague west of Carnatic ; probably about 1793. ib. 134 (12), Carnatic, parallels 10° to 13° ; 9 inches to degree ; shows Fort Defiance near Tripassore.
245 at end of note 10, *add* ; reduced to 40 m. to inch, 1795, MRIO. 67 (18).
note 11, *for* 65 *read* 66.
256 note 2, *after* IV, *read* 1840,
267 at end of note 1, *insert* ; cf. Williams (4–5, 11–2).
268 3rd para from bottom, line 1, *after* man of the sea, *insert* son of the shipwright organist of Rotherhithe,
line 4 and 5 from bottom, *delete* almost in sight... shore *and read* but a few days short of his Scottish port.
271 5th para, line 3 from bottom, *for* Ujohn *read* Upjohn.
275 note 3, *before* 11–2–1800 *insert* 574,
277 line 12 from bottom, *after* Colebrooke *delete comma.*
282 line 1, *after* 1795, *insert* and continued late as Surveyor General,
line 3, *for* 1576 *read* 1578.
line 4, *without inset.*
line 5, *for* The allowance included *read* The extra allowance of.
line 6, *delete* stop at end of line.
line 7, *for* On his recall...this sum *read* could not be drawn on his return to Bombay.

Addenda & Corrigenda, Vol. I

Page 282 line 4 from bottom, *after* [288] *change stop to comma and add* and on completion of his map he was granted a substantial gratuity.
delete final para Over and above...Rs. 702.
shift note 6 to end of note 1.

284 line 4 from bottom, against John Robinson, *for* 11 *read* 13.

285 under Assistant Revenue Surveyors, Madras, line 12, *after* inspection *insert full stop, and for* a *read* A.
line 20, *delete* This was endorsed by—*for* the *read* The *and after* Revenue *delete comma and add* agreed that
line 9 from bottom, *delete* Board of Revenue wrote to *and for* the *read* The.
line 8 from bottom, *after* sent *add* was told that
line 4 from bottom, *delete* to the districts.

286 delete notes 8 and 9.

287 note 3, *after* BM. *insert* Addl. MS.

290 note 1, *for* ib. *read* MPC.

294 last para. line 2, *for* possibly *read* possible.
line 3, *for* get *read* got.
line 5, *for* pursuing *read* persuing.

296 line 8 from bottom, *for* Mullah *read* Nullah.

303 line 20, *after* 256 n.6 *inside bracket add*, 330 *delete note* 4.

305 against p. 366, line 3, *after* Cock Match *insert* at Lucknow, *and at end of para after* Friends, *insert* with ref. to new note to read—Copies at IO, Foster (35) and VM. exbt. 1136.

306 col. 2, delete *GM. Gentleman's Magazine* (periodical).

308 under ADAMS, line 1, *after* Engrs. *insert* bapt. 20–4–37.
line 4, *for* Mother...Devonshire *read* Son of Joseph Adams, of Ashburton, Devon, and Eleanor Soper his wife.
line 7, *after* Hodson *add* I (8); IV (631).
col. 2, last line, *for* retured *read* returned.
note 10, *after* 934, *insert* 2010–11 *and after* Colebrooke *substitute square brackets round* 328 *and add*; several of his water-colour sketches at VM. and IO.; Foster (111).

309 under ANBUREY, line 2, *after* CP. *add*; MI.
line 8, *after* Hodson *add*, I (28); III (734); Crofton, I (68–9).
note 6, *for* (20·1a); *read* (20–1a); Foster, II (35, 114);
last line, add ref. to new note, to read 12 views, VM. exbts. 1636–47.

310 col. 2, under BAILLIE, line 3, *for* 1753 read 1752/3.
line 5, *before* Resd. *insert* furl. without pay 3 years from April 1785.
line 8, after Hodson insert; I (74); III (716, 737);

311 Insert at head of col. 1,
BAKE, Herman. German adventurer. d. 1677. Engr. & SG. Bombay, 1671, with rank first of Capt. and later Colonel.
Wrongly called Blake in *Gaz. Bombay City* [147 n.4].
Sent from Surat to Bombay, 1671, and appd. Engr. & SG., the Directors writing; "Wee have found him a very ingenious, pious, and well disposed person, and receive him in the quality of Ingineer and Surveigher General of your Island of Bombay during your pleasure". Again in 1673, in reply to a report from Bombay, "The good character you give of Captain Herman Bake makes us hope he may bee serviceable to us".
Survd. defence works and land; completion delayed by sickness.

Page 311 Authorities; *Bom. Dist Gaz.* XXVI, part II (269): Sandes, I (20); RE. Journal, LVIII, March 1944 (6); Fawcett (25, 77–110).
under BARKER, at end of line 6 *add* and Hannah Whitehead his wife.
line 10, *after* Hodson *insert* I (92); III (717, 739);
col. 2, line 7 from bottom, *after* [110, 193]. *add* 1788, made sketch of Ganjam town. *adding ref. to new note, to read* MRIO. 140 (9).
note 4, *for* indentity *read* identity.

312 note 8, *after* Martin *for* (I 64, *read* I (64, *and for* 216; II 173) *read* 216); II (173).

313 col. 2, *after para ending* Port Blair [49]. *insert new para, small type,*
Submitted plan of floating dock "for repairing His Majesty's Ships at Port Cornwallis". *with ref. to new note, to read* MRIO. 98 (26–7).
under BLUNT, line 4, *after* Taylors' *add* 1774–6.
line 5, *for* Miss Mary Bristow, *read* Mary, *nat.* dau. of John Bristow (1750–1802), BCS. [168],
line 8, *after* Hodson *insert*, I (170); III (746); IV (631).
note 9, *for* ts *read* its.

314 col. 1, line 22, after [51, 65], *change stop to comma, and insert* including svy. of road Diamond Harbour to Kidderpore. *adding ref. to new note, to read* MRIO. 43 (15, 16), 3–1–1799.

315 col. 2, *under* BRUCE, *penultimate line, after* Gwalior, *for comma read semi-colon, and in last line omit* and,
line 3 from bottom of col., *for* Glascow *read* Glasgow.
at end of note 16 *add* plan, 2 inches to furlong, MRIO. 187 (25).

316 under BURGESS, *above* Ens. *insert* d., Calcutta, March 1798—*below* Ens. *insert* m. Elizabeth Kerr.
after Hodson *insert* I (250); III (751).
after river-training *insert new line* After resn., traded at Nishal Bagh and Calcutta. *and a new para*
Ben Regr. 550 (103) records a *Plan of Sundeep I.* by David Burges, 1788, with copy of letter addressed to Warren Hastings. David (1754–1814) was BCS.; Collr. Purnea 1794; d. Arrah 1814; his sister, Margaret, m. Geo. Fleming (1760–1818), Ben. Engrs.

318 col. 2, at end of para 5, *after* 77 *insert*, 161 *and delete* 286.

321 under CALDWELL, Arthur. *line 2, after* d. *insert* Benares—*add as new line* Capt. 25–1–79.
line 4, before Father *change stop to semi-colon and insert* she d., London, 30–12–1832;
After Hodson *add*, III (752–3).
at end of last line, *after* army *change stop to semi-colon and add* dism. by ctml. for insubordination nr. Surat, 2–8–80, restored 21–5–81.

323 col 1, line 2. *for c.* 1749 *read* 1748/9.
line 11, *after* Hodson *add*, I (276); III (753).

324 under CAMAC, line 7, *add* Hodson, I (278); III (753).
add new final para.
In his road map of 1779 [230], Call includes "part of the country laid down by Major Camac from actual measurement, & partly from report, collected during his residence on these frontiers from the year 1769 to 1776".
at end of note 7, add Governor, Bombay, 1750–60: Foster, II (38–9).

325 under CAMPBELL, line 9, *after* 230 *change stop to semi-colon and add* Crofton, I (112).

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Page 325 line 17, *after* Farquhar *insert* [39 n.9].
note 13, *delete* A Robert Farquhar *and for* served *read* Served.
line 6, *after* Hodson *add*, I (361); III (758).
326 col. 1, *under* CARTER, line 4, *after* Hodson *insert*, I (314); III (719).
col. 2, *under* COLEBROOKE, line 6, *after* Hodson, *insert*, I (361); (758).
line 12, *after* Malden *insert semi-colon.*
line 13 and 14, *omit* and became the 1st Bart. *and after* 2nd son, *insert* James, was cr. Bart. 1759, with remainder to the 3rd son *and after* George *omit* became *and after* EIC. *for* and *read* who
328 at end of note 3, *add* ; MRIO. 138 (30–41).
note 6, *after* 935 *insert* 1291, 1299,
330 under CRIDLAND, *insert new line 6*, Hodson, I (411); III (761).
331 col. 1, at end of line 12, *after* IO. *insert ref. to new note to read*—
Many log-books destroyed by fire, Calcutta 1855, IO. 1860 ; *Imp Gaz.* IV (481).
332 col. 1, under DAVIDSON, *insert new line 4* Son of James Davidson, merch., of Dysart, NB. *and after* Hodson *change stop to comma and add*, II (17); III (764).
under DAVIS, line 2, *for* b. 1756–7 *read* bapt., Southwark, 26–1–55.
line 3, *for* 4–2–80 *read* 12–8–79
lines 8 and 9, *for* comdg. Resdt.'s escort in Nepal, 1817, *read* (1787–1838), Ben. Art.
line 12, *for* DNB. *read* FRS. ;
col. 2, at end of last para of Davis, *after* Astronomy *change stop to semi-colon and add* water-colour sketch at VM., exbts. 1657, 1659, 2209, and at IO. ; Foster, II (72).
note 9, for MPC. read MMC.
at end of note 16 *add* ; Hickey, IV (215–6).
333 at end of note 4, *add* cf. *RE. Journal* LVIII. March 1944 (7, 8).
334 under DELAFIELD, line 1, *for* Ben. *read* Mad.
line 3, *after* Ens. *insert* Mad. Est. 19–7–63 ; to Ben. Est.
line 6, *after* Hodson *add*, II (41); III (766).
Delete 2nd para, col. 2, from Identity by no means...Ens. 5–9–70 *and substitute*
Bolts, appx. xxxii ; Lieut. Delafield sent by Col. Richd. Smith, 7–12–66, to summon James Nicol from Benares [360].
under DON *above last line, insert new line* Probably 1803, survd. route Cawnpore to Agra, well drawn in coloured chalks. with *ref. to new note* MRIO. 31 (34–5).
note 7, *after* 1800 *insert semi-colon and after* Map *insert* 81, scale about 5 m. to inch,
at end of note 12 insert map, MRIO. 30 (43), beautifully drawn.
335 col. 2, line 13, *for* Bilous *read* Bilious.
note 13, *for* Srirangham *read* Srirangam.
337 under FORSTER, at end of line 4, change stop to semi-colon *and add* Crofton, I.
delete line 8, and substitute July 1788 to Feb. 1789, on mission to Nāgpur.
line 11, *after* Nāgpur, *insert* June.
col. 2, under GARDINER, line 7, *after* 1788. *add Ben Regr.* 184 (94), made plan of Chunārgarh and vicinity.
under GILCHRIST, after line 6, *insert new para. small type,*
Oldham, II (209); 1787, started as indigo planter near Ghāzipur ; "had learned the art of indigo manufacture...in the West Indies. ... Of considerable ability, but somewhat unscrupulous".

Page 337 at end of note 9, *insert* ; Murray, II (208–20).
338 col. 1, line 6, *for* Miss A. Baxter *read* Miss Anne Baxter—*below line 9 insert* FRS.
339 col. 1, *under* HOARE, line 4, *after* Hodson *add* I, (456); III (798).
340 col. 1, under HUMPHRAYS, at end of line 5, *after* Montgomery *add* and Margaret Bright his wife
line 6, *after* 86 *insert ref. to new note, to read* Hickey, III (146), IV (490) gives date 16–2–86, from register, St. John's ch.
at end of line 7, *insert semi-colon. and* hence bro-in-law to Henry Watson [394].
line 8, after Hodson *add* I (501); III (801) *sv.* HUMPHREYS.
col. 2, *under* HUNTER line 9, *for* Mareschal *read* Marischal.
under HYDE, line 1, *after* Inf. *insert* b. 8–5–52 —*line 4, before* Mary *insert* David and
above Hodson *insert* ed. Merchant Taylors', 1762–5. *and, after* Hodson *change stop to semi-colon, and add* II (519–20); III (802).
341 col. 1, under IRONSIDE, *add new line 5* m., Calcutta, 13–5–65, Loetitia, dau. of Rev. Robt. Roberts, and sister of R. E. Roberts (1753/4–1831) Ben. Inf.
after Hodson *add* II (528); III (803).
col. 2, under JOHNSON, line 11 from bottom, *after* Mysore war *insert ref. to new note, to read* assisted by Wm. Cowper (1774–1825); Bom. Engrs. ; *EIMC.* III (195).
344 col. 1, at end of 3rd para from bottom, *after* created *add new para, small type,*
His name is still preserved in Madras, a channel running through the heart of Georgetown being known as "Kelly's scent-bottle".
col. 2, under KIRKPATRICK, line 7, *after DIB. inside bracket add* Crofton II (13).
below line 11, *insert new line* VM. exbt. 188, portrait by Thos. Hickey ; lb. 1438–9, copies of other portraits.
345 col. 1, under KNOX, line 3, *after* MI. *add* Civil Court compound, Patna.
under KYD, Alexander. line 12 *after* Hodson *insert* II (613); III (730, 810); for portrait by John Smart, *v.* our vol. II., pl. 19.
347 col. 1, line 20 from bottom, *after* 1806–27 *insert ref. to new note to read* MRIO. 50 (2, 3).
at end of line 5 from bottom, *after* London. *add* Probably the Alexander Kyd, ed. at Westminster, Ladyday 1811 to 1814 ; *OW.* I (547).
col. 2, under Robert KYD, *before* Uncle *in line 5, insert* Son of Thomas Kyd, merch. "of an old Forfarshire family".
line 7, *after* Hodson *add*, II (613); III (810).
348 col. 1, above LAW de LAURISTON, *insert*
LACAM, Benjamin. Marine Survr.
b. 20–5–38. d. 21–12–1813.
arrd. India as mdpn. 1760.
Of French extraction ; son of John & Henrietta Lacam ; bro. of Francis (b. 1739), 4th officer of *Pococke*, E. Indiaman, 1763.
m., Calcutta, 25–3–73, Miss Kitty Statham, who d. in England 1830.
HMS. 396 (59 *et seq*).
Dman. & Asst. under CE. Ft. William ; from 1770 worked on scheme for new Harbour on Hooghly, making several svys. of the river, and pubg. maps of Hooghly and N. coasts of Bay [50].
Settled in Cecil St., Strand, London, where he died.

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Page 348 *under* LAW, line 7, *for* Jaques *read* Jacques
at end of line 12 after *Frenchmen* change stop to semi-colon *and add* Miniatures of his nephew Jacques, etc., at IO.; Foster, II (34).
col. 2, under LENDRUM, at end of line 7 *add* DDn. 278 (197), svy. of Caranja, Elephanta, and Hog Is. Bombay.

349 col. 1, *above* MACKENZIE, *insert*
MACDONALD, John. Ben. Engrs.
b. 30–10–59, I. of Skye. d. 16–8–1831; MI. at Exeter Cath.
Ens. Bom. Engrs., 6–4–81; to Ben. Engrs. Sept. 1782; ... furl. on mc. 1796; Capt. 8–1–98; ret. 30–7–1800.
Son of Allan Macdonald, of Kingsburgh, Capt. 84th Foot, and his wife Flora Macdonald, the Jacobite heroine (*DNB.*).
ed. Edinburgh.
m., 1st., Ft. Marlbro', c. 1784, Nancy Scott, dau. of Geo. Salmon, and widow of Lawrence Bogle, Sec. at Ft. Marlbro'; she d. Bencoolen, 28–10–86, aged 25.
m., 2nd, 24–10–99, Francis Maria, dau. of Sir Robt. Chambers, Kt., CJ. of Bengal.
FRS. 1800; *DNB.*; Hodson, III (122–3).
Arrd. India 1780/1 as cadet for Bom. Inf.; but tr. to Engrs.; leave to Calcutta 1782, and appd. to Ben. Engrs.; to Bencoolen, Sumatra, 1783, and employed on svy.
1787, directed by GG in C. to svy. Isd. and Harbour of PWI.; on arrival at Penang in *Ravensworth*, found that Kyd had already completed svy.* so proceeded to Calcutta, where he reported on his Sumatra svys. to the SG.†
1788, returned to Bencoolen as Mil. and Civ. Engr. with local rank of Capt.; 1789–93, made large-scale svys. of several harbours, with soundings and sailings directions, and magnificent panoramas as seen from the sea. The sailing directions indicate nautical experience, but his svy. of Tapoonally harbour may have been made in co-operation with Capt. Moresome, HM. Navy, whose chart of harbour is preserved with Macdonald's, dated 1789‡.
Auth. of several mil. and technical engr. works, and translations from French and German.
Add as notes—
*BMC. 20–7–87. †ib. 17–9–87 (30).
‡MRIO. 105 (16), Tapoonally, by Macdonald; ib. (17), by Moresome; ib. (38), Mansillar, 1789; ib. (39), Marlboro' Roads & Poolo Bay, 1793, all by Macdonald.
Under MACKENZIE, *line 2, for* c. 1753 *read* 1754.
lines 2, 8, 11, for Stornaway *read* Stornoway.
line 20, *after* 1815, *change stop to semicolon, and add* FRS. 10–6–19.
line 21, *after* (bio-sketch) *change stop to semi-colon and add EIMC.* III.
col. 2, lines 13 and 14 and note 7, *for* Johnston *read* Johnson.
at end of note 7, *insert* name spelled Johnston after 1785.

350 col. 1, 3rd para. from bottom, line 1, *for* Makenzie *read* Mackenzie.
col. 2, line 17, *after* Manila *insert ref. to new note to read*, including plan of Manila Bay for use in forthcoming operations, MRIO. 104 (2).

352 col. 1, last para of MACKENZIE, line 5 from bottom *delete* [97].
col. 1, under MacLEOD, line 5 from bottom, *after* Agra *insert ref. to new note, to read*, MRIO. 31 (29, 31, 32).

Page 352 *above final para* Sold ... situated. *insert* MRIO. 73 (54), original route sketch Jubbulpore to Mandla, not dated.
col. 2, under MARSACK, line 11, change stop to semi-colon, *and add* Hodson III (227).

353 col. 1, under MARTIN, line 9, *after* Besson, *change stop to semi-colon, and add* Hodson, II (237–8).
at end of note 12, *add* MRIO. 52 (5–8) are original and copies of Martin's svy. S. of Calcutta; ib. (12) is probably also Martin's work, scale 2 geo. m. to inch, from Calcutta, north to Ganges, bounded on W. by Hooghly and Cossimbāzār rivers, and extending 50 m. to E.; *v* Rennell's index [224].

355 col. 2, lines 6 and 7, *for* at the end of February *read* in March *and for* was shipwrecked *to end of para. read* landed at Gravesend 9–9–1807, but was drowned off the English coast before reaching home, six months later [268]. *with ref. to new note*, to read *Aberdeen Journal*, 31–5–1809; IO Logs. *Asia.*
under McLUER, line 10, *after* 20–8–90 *insert ref. to new note, to read* MRIO. folio 110.

359 col. 1, line 3, *for* Miss Mary Touchet, *read* Mary, sister of Peter Touchet, BCS. 1779. *and add ref. to new note to read OW.* II (924); Hickey, III (222).
at end of line 16, *after* [30, 39] *add ref. to new note* to read *Nagpur Territories* (27).
at end of para 4 from bottom of MOTTE, *after* October 3rd, *add* From having been "one of the greatest merchants in Asia", became dependant on the charity of his friends; Hickey, III (222).
col. 2, line 14 from bottom of MOUAT, *before* behaviour *insert* ***hyphen*** .....

360 col. 1, under NICOL, between lines 5 and 6 *insert new line* Hodson, III (390–1).
col. 2, line 3 from bottom, *after* pl. 18 *add ref. to new note to read* Plaster bust, 1774, at IO.; Foster (78).
note 5, *after* Bolts *insert*, appx. xxxii.

361 col. 1, at end of 1st para., *after* a year. *add* Historical papers preserved at IO. as Orme MSS.
under ORPEN, line 4, *for* Sherriff *read* Sheriff.

362 col. 1, 5th para., line 4 from bottom, *for* soh as *read* so has.
6th para, line 2, *after* think *insert comma*

363 col. 2, under PITTMAN, *delete last para.* There is an...another son".

366 col. 1, 5th para., line 4, *after* MSS. *insert ref. to new note, to read*—
Polier sold more than 550 vols. from his oriental mss. to Pote [204], many containing his seal or autograph; *v. Catalogue of the Oriental Manuscripts in the Library of Eton College.* Margoliouth. 1904.

370 note 9, *for* ten *read* then.

372 note 1, *after* Martin *insert semi-colon.*

377 note 5, *over* first e *of* Grandpere *add grave accent.*

378 col. 1, *under* REYNOLDS, below line 4 and *above* SG. Bombay *insert new para. to read*—
Possibly son of William Reynolds, baker, of Bloomsbury, adm. St. Paul's School, 7–4–1769, aged 12.
lines 5 and 6, *for* two sons...Bom. Est. *read* 3 sons, George, John, and Wm., the two last joining Bom. Army.

380 note 4, *for* 89 *read* 1808.

381 col. 2, line 2, *after* Benares. *insert ref. to new note, to read* Journals and lat. obsns., DDn. 162.

382 col. 1, under ROBERTSON, Thomas, line 5, *after* Edinburgh, *insert* 4–11–99.

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Page 382 under ROBINSON, line 4, *after* [54] *for* and *read* beautifully drawn, with bold hand-printing ;
col. 2, under RUSSELL, line 5, *for* David Elliott *read* Daniel Elliot.

383 col. 2, under SCOTT, Andrew, line 3, *after* MI. *change stop to comma, and add* St. George's Cath. cem.
add final para. to read From 1803, senior judge in Madras ; 1808, gave Lambton his warm support ; 1822, unemployed.
under SHOWERS, line 5 from bottom, *for* who had been drowned at sea *read*, bur. Calcutta, 25–11–76.

384 col. 1, line 12, *after* O'Halloran *insert ref. to new note to read* became M Gen. Sir Joseph O'Halloran (1763–1843) ; Kt. ; GCB. ; *DNB.*
under SMITH, *delete 1st para.* Has not been...of his survey. *and substitute*
Birth, parentage, and date of death unknown.
31–10–65 to 7–1–70, Asst. Curate, Thorney Abbey, nr. Peterborough ; 11–2–67, wrote to RS. regarding "salamander's wool"[6].
CM. 31–1–70, "permitted to proceed to India as a mariner" ; IO Log, 356 D., Wm. Smith, passenger in EIC. ship *Queen*, left Plymouth 6–1–71 ; arrd. Madras 14–6–71.
delete note 6, *from* eg. Rev. ... *to* 11–2–67.
note 7, *before* Journal *insert* Original *and after* 29213 *insert* fair copy, DDn. 162 ; M 243.
note 10, *before* records *insert* the Society *and after* records *delete* of RS.—*after* FRS. *delete remainder of note.*

385 col. 1, 2nd para., lines 1 and 2 *after* Balasore *insert* via Bīdar, Hyderābād, Ellore, Khāsimcottah, Vizianagram, Chicacole, Ganjam, Chilka Lake, Puri and Cuttack ; *then for* and *read* he *and omit* again.
col. 2, at end of 2nd para. *after* the appt. *change stop to comma and add* and settled in Tewksbury, but not as vicar.
delete next para. from Nothing further...d. 1787 *and substitute*—
18–8–87, wrote to RS. from Tewksbury, discussing "two exotics...gathered in November 1775...between Serunge and Brampore...in the country of the Mahrattas", which he sent with the letter.
Here insert reference to new note to read BM. Addl. MS. 33977 (138), in same handwriting as the letter from Thorney Abbey, and the Journal [31 n.9, 384 n.7].
note 2, *after* 93 *delete* Map 16 *and at end of note insert* Map, MRIO. 63 (20), scale 18 m. to inch, with no dates.

386 col. 2, under William STEWART, *insert new line 9* Hodson, IV (193) ; Crofton, II (1).
under STOKOE, *line 5 for*, reduced...Surat *read* map of Goddard's marches, scale 12 m. to inch.

387 col. 1, under SYDENHAM, Benjamin, line 14, *after* Hyderābād, *insert* ref. to new note, *to read* DDn. 44–M 132, Fdbk. Ellore 26–4–98 to Hdbd. 26–5–98 ; theodolite traverse ; neat daily sketches.
under SYDENHAM, Thomas, at end of line 8, change stop to semi-colon, *and add* MI., Crofton, II (2).
at end of line 9 change stop to semi-colon, *and add* portrait, VM. exbt. 1441.
col. 2, under TAVERNIER, at end of line 13 *after* Ball *change stop to semi-colon and add* Murray, II (202–7) ; portrait, VM. exbt. 1253.

388 col. 1, under TIEFFENTHALER, line 3, *for* Bolzana *read* Bolzano.

Page 389 *under* TOPPING, line 2, *for* c. 1747 *read* 4–7–47.
delete lines 3 and 4 up to his sound...*and substitute*
Son of Michael Topping (1704–89), shipwright of Poplar, and Rebecca his wife. Michael sr. settled in Rotherhithe before 1744, and was appd. organist at St. Mary's ch. from 17–12–65 on salary £ 30 p.a. In will dated 10–1–88, he bequeathed "my chamber Organ in the glass case in back parlour, and all my drawings and prints, and all my books and pictures, at the decease of my dear wife, unto my son Michael Topping to his use if he shall then be living, and if not to his lawful issue". Of his other sons, Frederick (1756–87), architect, E. Greenwich, exbtd. design for organ at Soc. of Artists, 1774, and Thomas was apprenticed, 1772, to a Stationer & Bookseller, Rateliffe Cross*.
By 1785 Michael jr. had a sound (*then continue line 2 of 1st para.*).
at end of this first para., *following* Warren Hastings *insert new paras.*
He inherited his father's love for ships, for sketching, and for the organ [392]. *GM.* vol. 84, 1814 (433) shews a drawing of the Great Church at Calais taken by him in 1776, "when sailing in his cutter...from Deptford round the North Foreland"†.
Williamson's *History of Portrait Miniatures* ‡ records portrait sketch of Michael jr. made in Nov. 1796, obviously at Madras, "by John Smart jr., from an original drawing".
As purser, sailed from Portsmouth, in EIC. ship Atlas, 7–3–79, which arrd. Madras 18–1–80 and returned to England by Oct. 1781.
No corroboration has been found of Markham's suggestion that he had been a ship's captain§
Add notes—
**Memorials...St. Mary, Rotherhithe*, by E. J. Beck. Cambridge, 1907– †cf. *GM.* 1816 ; vol. 86, part ii (220). ‡ pub. Geo. Bell. vol. II, *sv.* John Smart jr. (*DNB.*). § Markham (6).
at end of note 10, *insert* ; chart, MRIO. 100 (29).

390 note 3, *for* ib., *read* "Chart of the Track of... cutter Mary, 1790–1791," MRIO. 100 (29).

391 col. 2, line 8 from bottom, *for* convenanted *read* covenanted.

392 col. 2, 5th para. from bottom, *for* Topping had other interests besides his work, *read* His father's lessons on the organ were not lost ;
delete 3rd para. from bottom, It would be interesting...left England, *and substitute running continuous with previous para., after* Coromandel.—Hodges was in India from 1778–84, and may have met Topping as purser in the *Atlas.*

393 col. 1, *delete para.* 5, The only other Topping...in 1801.

394 col. 1, line 2 under TURNER, for *c.* 1759 *read* 1757/8.
col. 2 under WATSON, line 7, *after* Ben. Inf. *insert* [340].
at end of line 10, add Sandes, II (175).
lines 8 and 9 from bottom, *after* eight years *change comma to stop and delete* and in 1788... 32 guns ; *indicating omission.*
above line 5 from bottom insert new para. small type, to read Hickey tells us that "Colonel Watson was so greatly attached to Bengal that he would never have quitted it had not his health failed. ... He was constantly out from morning to night, ... and though he had

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Page 394 several fevers in consequence would never allow that they were brought on by the sun. At last, however, his original vigorous constitution was so seriously impaired that he was driven to the necessity of trying the effect of a change of climate". He survived the voyage home only to die two days after landing at Dover. *with ref. to new note, to read* Hickey, III (269).

395 col. 2, *delete* WHITEMAN or *and for* WITTMAN *read* WITTMANN *and for* Henray *read* Henry.
line 5, *for* Obviously of German origin *read* Probably one of the German officers brought out in 1769.
at end of line 9, *after* [147] *change stop to semi-colon and add* MRIO. 124 (25), Sketch of Island of Salsette, sd. C. H. Wittmann ; ib. (26), also of Salsette 1781.
for last para. 1777–8...etc.]. *Substitute*
1777, to Europe to recruit German artificers for Art. Company, and returned 1779 with 25 men [CM. 25–6–78, *et seq*] ; *Bom. Dist. Gaz.* XXVI part ii (424–30).
1780–1 on mil. service in Konkan, and 1783, under Torriano at defence of Onore [393].
col. 2, *under* WILFORD, *for 1st para.* No record...male side *substitute*
It is recorded in Embarkation Rolls, IO., that Francis Edmund Wilford, clerk, native of Germany, aged 26, sailed as a soldier in the *Ceres* for Bengal, 28–2–77. Identity may be presumed, but even if born in Germany his names and subsequent writings indicate English parentage and education.*
No trace of name found in Hanover State Archives.
Insert note *Father Hosten's suggestion of Hanoverian or Swiss origin (*Commentarius* 526 n.) may have its source in the entry above quoted.

396 col. 1, 3rd para., line 4, *after* Benares. *Insert* new para. *small type, to read—*
Oldham, II (87) records letter from Jonathan Duncan, 19–3–89, asking Wilford to make full report for "each mehal or separate district... under the following heads :—Soil—Produce—...Zoology—Natural History — ... Curiosities, Ruins, etc.", and suggests that "the influence of Mr. Duncan may have stimulated, if it did not first awake, the antiquarian zeal of Captain Wilford". Duncan (1756–1811) was Resdt. Benares 1787–95 ; Govr. Bombay 1795–1811 ; *DNB.*
3rd para. line 5, *for* he *read* Wilford.

397 under Mark WOOD, *at end of 1st para. in large type* 1770...Engrs. *add* 1774, ran lines of level through Calcutta, which he extended during 1783–4 [53].

398 col. 2, under Thomas WOOD, line 6, *delete* 1st...2nd.

399 col. 2, line 10, *after* Calcutta *insert*, assisting Colebrooke in drawing map of the Upper Provinces [232].

INDEX

Adams *after* Maj. Thomas *for* (d. 1764) *read* (*c* 1730–64) *DNB.* ;
Anderson *after* Hodson *insert*, III (715–6).
Andrade *after* 1634 *insert* ; SJ. ;
Bake *after* Bake *delete* or Blake.
Bird line 2, *for* 56 *read* 76.
Bolts *after* 1808) *insert* ; BCS., factor 1759 ;
Bourchier *for* Governer *read* Governor—*line 2, after* 60 *insert* ; Foster II (38–9) ;
Bourzet *for* Bourzet, cartographer *read* Bourcet, de, engineer.
Bourdonnais *for remainder of entry read* see La Bourdonnais.
above Burhānpur *insert* Burges, David (1754–1814), BCS. 316.
Campbell *after* (1739–91) ; *insert* KCB. 1785 ;
Cassini line 3, *after* (1677–1756) *insert* assumed suffix de Thury ; for Francois read François.
Dalby *after* (1744–1824) *insert*, mathematician.,
Desideri *after* (Hippolyte) *insert* ; SJ. ;
Elliot *before* 1778 *for* d. *read* 1754/5 *and after* Ben. Civ. *insert* 1771.
Emperors line 4, *after* 1658—*insert* 1707.
Farquhar *for* d. 1778 *read* 1755–78 *and after bracket enter* Crofton, I (109–10).
Feltham *after* 1767 *insert* –84 ; *after* Hodson *insert*, II (169) ; III (776).
Forde after *Ency. Brit.* insert Hodson, II (203) ; III (779).
Fortnom *after* Hodson *insert*, II (209) ; III (723, 777).
Francklin *before* Ben. Inf. *insert* OW., I (349).
Freyre *after* Father *insert* ; SJ.
Fulcher *after* Hodson *insert*, II (232) ; III (781).
Graham *delete* d *of* apprenticed.
Harris line 2, after *DIB.* ; insert *OW.*, I (428–9) ;
Hastings line 1, *after* Warren :—*insert* MCS. 1750.
line 2, *after* 1773–85 *insert DNB.* ; *OW.*, I (435–6) ;
Hickey *after* Wm. *insert* (1749– *c.* 1830) ; *OW.*, I (456) ;
Home *for* (1711–98) *read* (1751/2–1834) ; *DNB.; DIB. ;*
Humberstone *after* (1753–83), *insert DNB. ;*
Hutton *after* (1737–1823) *insert* ; mathematician ;
Impey after *DIB.* ; insert ; *OW.*, I (501) ;
Johnston *for* Johnston, Alexander senr., *read* Johns(t)on, Samuel *and after* (b. 1750) *insert* MCS. 1781 ; dism. 1792 ;
Karamnasa *delete* 395.
above La Caille *insert* La Bourdonnais, Adm. Bertrand-François Mahé Comte de (1699–1751), 93.
La Caille *after* Abbé *insert* Nicholas
Lacam delete whole entry.
Lawrence *before* Maj Gen. *insert colon and dash*
line 2, *for* Madras *read* Nīlgiri Hills.
Maskelyne *before* Nevil *insert* Rev. *and before* FRS. ; *insert* AR. 1765–1811 ; DD. ; *and before* 155 *insert OW.*, II (629) ;
Mathews *delete* Sir.
Monson *before* George *for* Colonel *read* The Hon.—*before DNB. insert* Ens. HM. 1st FtGds. 1750 ; LtGen. 1771.—*after DIB.* ; *insert OW.*, II (653–4).
Morgan *after* Charles ; *insert* Ens. HM. 1st Footguards, 1750 ; *and after* 1765 ; *insert* Lt Gen. 1777.
Napier *after* (1550–1617) ; *insert* inventor of logarithms ;
Nieburh *after* Carsten *insert* (1733–1815) ; German traveller ; *Ency. Brit.*
O'Halloran *before* Joseph *insert* M Gen. Sir.
above Ordnance *insert* Opie, John (1761–1807), RA. ; *DNB.* ; *Ency. Brit.* ; 378.
after Ovington *insert* Ovington, Rev. John ; chpn. Surat, 1690–3, 120.
Pigot *before* Baron *insert* ; MCS. 1737 ; cr.—*after* Baron *insert* 1766.
Plassey *after* battle of, *insert* 23–6–57 ;
rai'yat *whole line to italics.*
Ramsden *before* DNB. *insert* FRS. ;

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Ringrose — *after* John *insert* (b. c. 1757) *for* 1st Lieut. 1784 *read* 1772–90 ;

Roxburgh — *after* Dr. *insert* Wm. *and before* Botanist *insert* FLS. ; FRAS. ;

ryot—ryotwāri — in italics.

Shakespeare — *after* Wm. *insert* (1564–1616).

Smith — William Bruce, *for* 1780 *read* 1770.

Son R. — *after* 29 *insert* 30.

Stancliffe — *after* Stancliffe *insert* John.

Stuart — *after* James *insert* (d. 1793) *and for* Joseph *read* James.

Upton — *for* Colonel *read* Lt.Col. *and after* John *insert* d., Contai, Midnapore, 1780.

Walker — line 1, *for* James *read* John.

Watson — after *DNB.* ; insert *OW.*, II (972).

Waugh — *before* vii *insert DNB.* ;

Wellesley — line 3, *before* 347 *insert* 264 n.6, 308 *and after* 347 *delete* 371.

White — *before* a journey *insert* J.,

Zoffany — *this line should read* Zoffany, Johann (1733–1810) ; artist., of Ratisbon. 366.

Postscript.

Page 385 *under* STEVENS *line 15, after* works. *change point to comma and add* with sole charge of erecting the fort.

Page 386 col. 1, after line 19 insert new para before 5th para, *to read* IO Misc. 17–4–83, M Sel C. 17–12–78, Thos Rumbold, Govr., hears that Stevens left to EIC. "all Plans, Charts, and mathematical instruments". Estate only 2000 *ps.*

Addenda & Corrigenda, Vol. II

Page 21 note 4, *for* Hasting's *read* Hastings'

91 Section Headings, line 1, for *Season, February* read *Period, January*

93, 95 Section Headings, *for* Season *read* Period

95 Delete note 4, and *substitute* 4 Lt Col. John Montresor (1768–1805), comdg. HM. 77th Ft.

152, 163 Section Headings, *for* Establishment *read* Establishments

195 under Madras Observatory, at end of 3rd para, *after* I, 180–1 *insert inside bracket*, II, 451

197 Section Headings, line 3, before *Traverse Tables* insert *Java—*

233 Section Headings, for *Extension Northwards* read *Northward Extension.*

264 under Appreciations, line 5, *after* 1805 *insert comma*

287 *Section Heading,* Maps for the Court of Directors *omit* the

293 Page Heading, *delete* ; Madras

305 Section Heading, *should read* Surveyor General, Bombay

Page 320 under class IV, *for* R. Williams *read* R. Williames

324, 333 Section Headings, *for* Lambton's Survey *read* Lambton's Surveyors

338 note 1, *for* ib. *read* Bo MC.

339 note 1, *for* ib. *read* Bo RC.

365 line 7, *for* usuel *read* usual

400 under GARSTIN, line 7 and beginning of line 8 *should read* had another, probably elder, son, Edward, who m. Mary—and d. 1779, having posthumous son,

403 under GRINDLAY, between line 6 and 7 *insert new para to read* 1808–9, with mission to Sind [168–9], making sketch of "Sindree on the Eastern Branch of the Indus, since submerged by the earthquake of 1819". Print of this sketch faces p. 308 of vol. I of Burne's *Bokhara*, *v.* notes by Burnes, p. 312, and by Grindlay pp. 325–6.

421 note 6, *for* (115) *read* (73), *and after* 6–7–03 *add* (3–4).

Plate 21 note, line 3, *for* carrer *read* career

PREFACE

When I first started to collect material for these records I cheerfully bundled together everything earlier than 1830 for the first volume, as being of little serious professional interest, and now the first volume has only brought us to 1800 and the second is confined to the next fifteen years. Can there really be anything of sufficient interest in these little known years to waste a whole volume over? Well—I have personally found plenty to interest me, and much important survey history to record.

In the south there were considerable territories acquired from Tipu Sultān to be surveyed and settled, and in the north the Company's troops now advanced beyond Delhi, even to the Sutlej. There was a great deal of geography to be learnt.

The task was becoming too much for individual surveyors, each working along his particular road, and wondering how it would fit into the Surveyor General's latest jigsaw map. True, the Bengal surveyors had perforce to struggle along in this blindfold way for many years yet, but down in the south the way to better things was pointed by two great surveyors. Colin Mackenzie insisted that surveyors should be grouped into sensible parties, tackling each district or province in turn, and not turning aside until that area was completely surveyed on a definite system, and all information collected that would serve civil and military purposes. William Lambton had still wider views, and insisted that his general survey should be so based on the highest scientific principles that it should cover the peninsula from coast to coast, from sea to mountain, fixing the true position of a multitude of key points with unassailable accuracy. Nay more—his work should contribute to a determination of the true form of the great globe itself. The first conceptions, and the first labours, of these two great surveyors occupy a large share of this volume.

It was down south, likewise, and during this period, that the Austrian officer, Anthony Troyer, introduced the planetable to military officers. It was down south that the country-born assistant surveyors were trained at the school founded by Michael Topping, and were now to prove their worth, and provide the nucleus from which sprang the civil establishments of the future.

During the early years of the century there was much marching and countermarching of the Company's troops through central and north-west India. Military columns, accompanied by surveyors, engaged elusive enemies. The country was unhealthy, the heat exhausting. Geography was vague, and beyond the main roads commanders were entirely in the dark. Large areas were yet to be explored for the first time.

England was still at war with France. Napoleon was dreaming of the invasion of India, and surveyors were thrust out westward, even beyond the Indus, and across the waters and deserts to Persia.

This was still the age when maps had to be copied by hand, and each copy jealously guarded. Geographical information was of such great value that it had to be kept secret from all possible adversaries, and even the art of survey was not to be taught except to the Company's own trusted servants. The secrets of the face of the land were as jealously guarded as those of the atom bomb in these days. The district officer was expected to work without a map.

But we are not confined to professional matters. The surveyors were mostly young men new to the country, who were thrilled with the strange things they saw, and did not hesitate to record what they met in the villages or in the wilds of jungles and hills. Their journals and private letters contain much picturesque detail, refreshing pages hidden in dry-as-dust government archives.

Then, for the proper understanding of map-making, it is not sufficient to study reports, correspondence, or even journals. The maps themselves are the substance of the work, and must be examined in detail to appreciate the toil and devotion of

the surveyors and draughtsmen, and the essential atmosphere they breathed. So, in contrast to the first volume, for which illustrations and maps were collected mostly from the India Office and the British Museum, those for volumes II and III have been drawn mostly from departmental collections. I spent nearly three months at Dehra Dūn examining the early maps of the department, and was amazed at the wealth of beautiful drawing and artistic talent, the devoted labour, and the zeal and skill of the early surveyors. Knowledge of the conditions and circumstances in which they worked makes one marvel the more at the work they turned out.

Of manuscript maps earlier than 1860 the Survey of India holds literally thousands upon thousands. In a very few cases there are as many as three or four copies of one map ; but the great majority are single, original or a copy, one or other having been sent to India House in London. They are not all in good condition—the climate is all against that—but expert attention may yet preserve the greater part for future study. The publication of this series of *Historical Records* does not exhaust the interest of the originals, whether maps, journals, or correspondence. The more the story is set out, the greater the interest possible.

So far as possible this volume includes specimens of characteristic maps of various classes in the different provinces. It is not always the best surveys that lend themselves to publication ; they are sometimes too much like modern maps to be really interesting. It is often the work of the talented artist, rather than that of the accurate and painstaking surveyor, that sees the light of print. But that is the world all over.

It is noticeable that the untrammelled skilled and artistic surveyor often represents the character of the country far more effectively by symbols of his own design than is ever possible from a standardized table of conventional signs. The meaning of his symbols leaps to the eye.

It is interesting in these days of stern control to note the large expenditure that was allowed for these early surveys, but the Company was commercially minded, and by no means spendthrift. This expenditure was only authorized, after serious consideration, for surveys that were essential for administration and defence. The strictest economy was required.

Some readers of my first volume would have liked a fuller account of the historical setting, but the political events of the period were kaleidoscopic, and would have been difficult to describe more clearly with the necessary brevity. So much has already been written of the early political and military history by able historians, that I have been reluctant to introduce more than essential, at the possible sacrifice of details of the survey story that might otherwise be irretrievably lost. The historical events of the nineteenth century are possibly more clear cut, and it is hoped are here sufficiently explained for the clear understanding of the survey story.

The mass of material available seems to increase with each decade, and strict selection and stern compression has become increasingly necessary. However picturesque is much of the correspondence of our grandfathers, many of their lengthy rotund phrases have had to be clipped.

It was most distressing to find that so long a list of corrections had to be added to the first volume, and still more so to find that many more have now to be recorded. The proofs of the first volume were all dealt with during the war years. I trust that the errors that have escaped scrutiny in this second volume will be few and far between.

I make no apology for those amendments and additions that are due to fresh information that has reached me from many sources. Many of them are due to my own researches in the map rooms at Dehra Dūn. Others have come from friends both in India and England. I have been particularly delighted to have discovered the parentage of that talented man, Michael Topping. I have even secured his portrait. Though I have found a little more about the Rev. William Smith, his birth, parentage, and death, have yet to be disentangled from those of his many

namesakes who had entered the church in the days of George III. I have rejoiced to discover the existence of portraits of Alexander Kyd and Robert Colebrooke.

I call attention to the writings of great men that are quoted on an earlier page. I was particularly pleased to meet Colonel Hobday's evidence to justify my pursuit of these records. The work of our pioneers should not be forgotten. Our geodesists of the 20th century have great advantages, but I am pleased to remind them that William Lambton did not neglect to correct his triangles for spherical excess, and had a shrewd suspicion of the influences of underground variations of density.

My thanks are due to Dr. Sen, Director of Archives, and to his staff at New Delhi, for their unfailing assistance, and for their cheerful readiness to assume charge of the old Survey correspondence of the 18th and 19th centuries, which passed to their safe keeping early in 1947—to Major Hodson, whose third and fourth volumes of the *List of Officers of the Bengal Army* have now been issued—and to Lt. Colonel Percy-Smith, librarian of the Society of Genealogists in London, both of whom have taken great trouble in providing me with biographical information about all sorts and conditions of men.

I have also to express thanks to Sir Oliver Wheeler for the interest and help he has given in the successful issue of the first volume, and to Mr. Williams and the staff of the Survey Printing Office at Dehra Dūn, and to the staff of the Map Publication Office, and of the Map Record and Issue Office, at Hathibarkala, for excellent professional work.

SRINAGAR.
APRIL 1948.

R. H. PHILLIMORE.

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It has not been possible to retain plates 19 to 23 in the serial order first planned.

References to MS. Records & other Abbreviations

Appx.	..	Appendix
B to CD.	..	Bengal Letter to Court of Directors
B G O.	..	Bengal General Order
B J C.	..	Bengal Judicial Consultations
B M.	..	British Museum
B M Addl MS.		British Museum, Additional Manuscript
B M C.	..	Bengal Military Consultations
B P C.	..	Bengal Public Consultations
B Pol C.	..	Bengal Political Consultations
B R C.	..	Bengal Revenue Consultations
B S C.	..	Bengal Secret Consultations
B S & Pol.	..	Bengal Secret & Political Consultations
B S & Sep.	..	Bengal Secret and Separate Correspondence
B Sec to CD.	..	Bengal Secret Letter to Court of Directors
B T C.	..	Bengal Territorial Consultations
Bd.	..	Board
Ben.	..	Bengal
Bo.	..	Bombay
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Bo Pol C.	..	Bombay Political Consultations
Bo R C.	..	Bombay Revenue Consultations
Bo S C.	..	Bombay Secret Consultations
Bo S & Pol.	..	Bombay Secret & Political Consultations
Bo Sur.	..	Bombay Survey Correspondence
C-in-C.	..	Commander-in-Chief
C D.	..	Court of Directors
CD to B.	..	Court Despatch to Bengal
CD to Bo.	..	Court Despatch to Bombay
CD to M.	..	Court Despatch to Madras
C M.	..	Court Minutes, India House
C R O.	..	Commonwealth Relations Office (formerly I O.) Whitehall
Can Arch SR...		Public Archives of Canada, Ontario ; Search Reference
cf.	..	Compare
Com Cor.	..	Committee of Correspondence, India House
DDn.	..	Survey of India Records, transferred from Dehra Dūn to NAI., New Delhi, 1947
D L R.	..	Director of Land Records, Bengal
Dept/l.	..	Department/al
E.	..	East
E I C.	..	East India Company
et seq.	..	and following
Fdbk.	..	Fieldbook
GBO Lib.	..	Survey of India Library, Dehra Dūn
G G/in C.	..	Governor General/in Council
G O.	..	General Order
Govt.	..	Government
H M S.	..	Home Miscellaneous Series, I O. / His Majesty's Ship
I O/Lib.	..	India Office (now CRO)/Library
I O Maps	..	India Office Map Room
I O Misc.	..	Miscellaneous letters received, I O.
I R D Lib.	..	Library, Imperial Record Department, (now NAI.) New Delhi
ib.	..	the same, as before
Inf.	..	Infantry
inf.	..	see below
J Cor.	..	Java Correspondence, NAI.
JGO	..	Java General Orders
J M C.	..	Java Military Consultations, or Proceedings
J Misc C.	..	Java Miscellaneous Consultations, or Proceedings
J P C.	..	Java Public Consultations
M.	..	Madras/Memoirs and Journals, Survey of India
M to CD.	..	Madras Letters to Court of Directors
MG O.	..	Madras General Orders
M I O.	..	Mathematical Office, Calcutta
M J C.	..	Madras Judicial Consultations
M M C.	..	Madras Military Consultations
M P C.	..	Madras Public Consultations
M R C.	..	Madras Revenue Consultations
M R I O.	..	Map Record & Issue Office, Survey of India
M R O.	..	Madras Record Office
M Rev Bd.	..	Proceedings of Madras Board of Revenue
M S.	..	Manuscript/Military Secretary
Mack MSS.	..	Mackenzie Manuscripts, I O.
Mad.	..	Madras
Misc.	..	Miscellaneous
N.	..	North
n.	..	Footnote
NAI.	..	National Archives of India, formerly IRD., New Delhi
N W P.	..	North West Provinces of Bengal
passim	..	here & there
Pol.	..	Political
Progs.	..	Proceedings
Pub./d/	..	Public/Publish/ed
Q M G.	..	Quartermaster General
qv.	..	which/whom/see
Rev.	..	Revenue/Reverend
S.	..	South
S G.	..	Surveyor General
S G O.	..	Surveyor General's Office
S of I.	..	Survey of India
sd.	..	signed
Sec.	..	Secret/Secretary
[*sic*]	..	thus, as printed
sup.	..	see above
T S.	..	Trigonometrical Survey MS. Record Volume
U P.	..	United Provinces of Agra & Oudh
v.	..	see
V M/Exbt.	..	Victoria Memorial Hall, Calcutta/Exhibit No.
V P/in C.	..	Vice-President/in Council
viz.	..	that is to say
W.	..	West
W O.	..	War Office/Records of
Wills	..	Wills preserved at IO., now CRO.

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Reference to Survey of India Map ; 72 L/12 : *v.* Key, pl. 24.

FURTHER ABBREVIATIONS : Pages 373, 374

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Archer	*Tours in Upper India.* ... Major Archer. 2 vols., London, 1833.
Arbuthnot	*Major General Sir Thomas Munro*...Arbuthnot. 2 vols., London, 1881.
As A R.	*Asiatic Annual Register* (periodical).
As J.	*Asiatic Journal* (periodical).
As R.	*Asiatic Researches* (periodical pubd. by ASB).
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Ben Ob.	*Bengal Obituary.* Calcutta, 1848.
Ben P & P.	*Bengal Past & Present* (periodical pubd. by Cal. Historical Soc.).
Ben Regr.	*A Register of Maps...of the Bengal Presidency.* Survey Com. 1838. 2 vols.; Calcutta. 1838.
Ben Sel.	*Selections from the Records of the Govt. of Bengal* (occasional).
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C G.	*Calcutta Gazette* (periodical).
Cadell	*History of the Bombay Army.* Patrick Cadell. London. 1938.
Cal A R.	*Calcutta Annual Register* (periodical).
Cal Alm.	*Calcutta Almanac & Bengal Directory* (periodical).
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Plate 3



CHAPTER I

GENERAL NARRATIVE

Historical Summary, 1800–15 — Southern India; Topographical Surveys — Lambton's Survey — Upper India — Bombay — Revenue Surveys — Conclusion.

THE close of the 18th century had brought the final defeat and death of Tipu Sultān, son of Haidar Ali, who had between them dominated the greater part of south India for nearly forty years, and swallowed up one small neighbour after another. From the time of the spectacular British victory at Seringapatam in May 1799, Mysore was hereafter wisely and peacefully governed by descendants of its ancient Hindu dynasty, and protected by the strong arm of British power, whilst, with the exception of Coorg, the bordering territories passed gradually to the regular administration of the Company.

The unwholesome rule of the Nawāb of the Carnatic was brought to an end in 1801, and these thickly populated districts were freed from the worst exactions of the tax collectors. The Nizām of Hyderābād, who had staunchly supported the British challenge to the tyrant of Mysore, sealed his friendship with treaties that guaranteed protection against the restless Marāthas, who now became the greatest danger to the peace of the continent. In 1795 they had attacked and defeated the Nizām in battle, and during the final struggle with Tipu they had shewn their distrust of the British by standing aside from the fight.

The wide extension of the Company's frontiers now made them vulnerable to Marātha intrigue in every direction, for Marātha territories stretched from the frontiers of Kanara and Mysore through the western Deccan to the Jumna, and from Mālwa through Nāgpur to Orissa. It was from Bombay and Poona that trouble came to a head, and broke out in 1803 into a great conflagration of war, which, in spite of the brilliant victories of the Madras army under Arthur Wellesley, and of the Bengal army under Lake, dragged on into 1806, when hostilities were brought to a close under peremptory orders from England.

By the end of this weary struggle the Company's territories in the north had extended to include the whole of Orissa, a considerable part of Bundelkhand, the districts of the upper Ganges–Jumna *doāb* northward to Sahāranpur, and the districts beyond the Jumna from Agra to Karnāl and Hissār. In the west, the rich districts of Gujarāt were added to the Company's narrow territories of Bombay, Salsette, and Surat. Geographical knowledge of these extensive areas was as yet vague, but surveyors either accompanied or followed closely behind the armies, and regular surveys were put in hand as soon as possible, though often cramped by military precautions.

Between 1808 and 1810 the scare of Napoleon's threat to invade India led to several political missions beyond the western frontiers, and drew surveyors to Sind and Persia, Peshāwar and Lahore, whilst a treaty with Ranjīt Singh extended the Company's control westward to the Sutlej.

Along the northern frontier which followed the foot of the Himālaya Mountains continued encroachments into the Company's districts brought on war with Nepāl at the end of 1814, and as a result of the peace treaty signed early in 1816 a new frontier line was defined, which the Gurkhas have loyally respected to this day. The Company surrendered most of the *tarai* lands coveted by Nepāl, but gained in exchange the Himālayan districts lying between the Kāli and the Sutlej, the regular survey of which was started by Hodgson in 1815.

SOUTHERN INDIA; TOPOGRAPHICAL SURVEYS

In contrast to the surveys of Upper India, those of the south proceeded smoothly under peaceful conditions, but, before the appointment of Colin Mackenzie as Surveyor General at the end of 1810, there was no single authority to direct them. Mackenzie had direct charge of the topographical surveys of Mysore and the Ceded Districts. The Revenue Board controlled the district surveys which were under the professional charge of the Inspector of Revenue Surveys, or of the Superintendent of Tank Repairs. The Quartermaster-General held charge of various military surveys, including those of the Military Institution, and William Lambton conducted his General, or Trigonometrical, survey quite independently.

After the overthrow of Tipu in 1799, Mackenzie was given charge of the survey of Mysore and Kanara, and commencing in 1800 he completed the field work by the middle of 1807 and the maps and memoirs twelve months later. He started with three European assistants but, the last being withdrawn in 1806, he was thereafter left with country-born lads from the observatory surveying school. In 1809 six of these young surveyors were sent up to survey the Ceded Districts of Bellary, Anantapur, Kurnool, and Cuddapah, and completed them in 1814.

Both these surveys were carried through on a regular system carefully thought out and tested by Mackenzie. Base-lines were measured at suitable intervals, and the whole country covered with triangulation. Detail was filled in by theodolite bearings and traverses, and protracted on either the one-inch or half-inch scale, particular attention being paid to administrative boundaries and villages. Comprehensive statistical memoirs on the resources of the country were compiled for each district.

Though Mackenzie himself took a large share in the boundary survey and main triangulation of Mysore, and personally supervised the compilation of the maps and memoirs, he took no active share in the survey of the Ceded Districts, though by the agency of a number of intelligent Indian interpreters he made a collection of historical and archæological records which he afterwards extended to other parts of India and Java, and which is almost better known than his surveys.

The district surveys were carried out by country-bred Assistant Revenue Surveyors, trained at the surveying school which Michael Topping founded in 1794. The boys were sent out, generally in pairs, to work under the immediate orders of the collectors of districts, first making a general topographical survey, and then surveying the tanks, watercourses and cultivated areas. The Company's Astronomer combined the duties of Superintendent of the Surveying School and Inspector of Revenue Surveys, offices held by John Goldingham until he went on furlough in 1805, and then by John Warren until 1810 when all these district surveys passed to the control of the Surveyor General. As the average age of these boys when they were first sent out to the districts was about fifteen years, it is not surprising that much of their early work was of very poor quality, but as time went on, and as Lambton's triangulation became available, their work steadily improved.

The Military Institution was founded at the end of 1804 by Lord William Bentinck, then Governor of Madras, for the education of selected military cadets in mathematics, drawing, survey, and military fortification. It was placed under Anthony Troyer, formerly an officer of the Austrian army, a member of Bentinck's staff, who had learnt the use of the plane-table at the military academy near Vienna, and now introduced it to the Madras Army. The students of the Institution spent several months each year on field survey, triangulating and planetabling a fresh area every year. By 1816, when the Institution was closed down, they had completed nearly 15,000 square miles, covering the greater part of North and South Arcot, and Chittoor. In 1810 Garling, one of the most successful of the students, took a party across to survey the Portuguese territories of Goa and, when all the military officers were withdrawn, he completed the survey and extended it to North Kanara with the help of assistant surveyors transferred from the district

surveys. Lambton thought so highly of Garling's triangulation that he embodied it into his general trigonometrical survey.

During various military expeditions route surveys had been carried on, some of them by the Corps of Guides. In 1806 this corps was merged into the Quartermaster-General's department, and at the same time the Quartermaster-General was given control of all maps and surveys other than the district surveys and those under Mackenzie and Lambton. The most important of these military surveys were those of Travancore and the Nizām's Dominions; in each case supervision was entrusted to the engineer officer in addition to his other duties, and he was given assistant surveyors from the Military Institution. Work proceeded in a sketchy and fragmentary manner, till all military officers were recalled to their units early in 1811.

The Madras Army was much shaken by the officers' mutiny of 1809, and in 1810 General Hewett, Commander-in-Chief of Bengal, was brought down to reorganize the army and its staff. On his recommendation, Mackenzie was appointed Surveyor General of Madras from 1st December 1810, and given control of all surveys except that of Lambton, those under the Tank Department, and purely military surveys required by the army. In April 1811 he was called away to be Chief Engineer on the Java expedition, and William Morison, Commissary General, acted for him. Mackenzie did not resume his duties at Madras till 1815 and, being then appointed Surveyor General of India, he remained at Madras for the next two years, making a complete reorganization of the survey department before moving to Calcutta.

LAMBTON'S SURVEY

At the end of November 1799, after Mackenzie had received orders for his detailed survey of Mysore, William Lambton, of His Majesty's 33rd Foot, who had only reached India two years earlier, put forward proposals for a "Mathematical and Geographical Survey" that should extend right across the peninsula from sea to sea. It was to serve as foundation for a general survey of the whole country and, being controlled by astronomical observations and carried out on scientific principles, it was to be capable of extension in any direction and to any distance. These proposals were warmly supported by Arthur Wellesley under whom Lambton was then serving, and also by Mackenzie.

Government approval was given in February 1800 and, after the purchase of instruments from Dr. Dinwiddie in Calcutta and the ordering of others from England, Lambton set out for Mysore in September. He measured a base-line near Bangalore, and during the next 18 months carried out a preliminary triangulation of Mysore which, though connecting at many points with Mackenzie's work, came too late to be of practical value except as check and confirmation, and, in fact, was superseded two years later.

Returning to Madras early in 1802, Lambton measured a base-line at St. Thomas' Mount as a start both for his triangles north and south through the Carnatic, and also for his east and west series across the peninsula. This base-line, carried out during April and May 1802, was the first operation of his general trigonometrical survey.

His great 36-inch theodolite, and other instruments, arrived from England in time for him to start triangulation at the end of September and, joined now by Warren as assistant, he completed a meridional arc from Cuddalore to Madras and by observations of latitude at both ends obtained a value for the length of a degree that was essential for his scientific work.

Twelve months later, having secured the services of Kater as second assistant, he set out westwards across Mysore and brought his triangles to the Malabar coast in 1805, a new base-line being measured by Warren near Bangalore. During 1805–6 he observed the first section of the great meridional arc through Bangalore that

was eventually to stretch up the centre of India from Cape Comorin to the Himālaya mountains.

Whilst Lambton kept the main triangles and astronomical observations in his own hands, Warren and Kater reconnoitred the country in advance, and extended secondary triangulation along the flanks, fixing prominent points and sketching in the main features of the country. Both these officers had, however, withdrawn from the survey before Lambton returned to Madras, and in 1807, when he started on his survey to the south, he took four officers from the Military Institution who completed the "general survey" of the South Peninsula by lines of secondary triangles, filled in with a network of minor triangles and the main features of the country.

Lambton himself extended his main triangles down the coast from Cuddalore to close on another base-line which he measured at Tanjore, and in 1808 he extended his great central arc southwards to Cape Comorin. Here in February 1809 he was caught up in military operations against Travancore, but was released after a few weeks, and during 1810 spent most of the year at Pondicherry, working on his computations and general map of the south peninsula.

Early in 1811 he moved to the Ceded Districts to extend the great arc northwards, but was now left with only two of his military assistants. He halted at Gooty to measure a new base-line and take astronomical observation, whilst Riddell continued the triangles north to Adoni, and then ran a main series south of parallel 16° eastwards to the sea, and another series southwards through Nellore to connect with work that Garling had brought up from Madras. Lambton himself moved down to Masulipatam and measured a base-line and took the necessary observations near the mouth of the Guntur, and then spent some months over computations and reports. At the end of 1811 he lost the last of his military officers, and was told that he must manage with his four sub-assistant surveyors from the observatory surveying school. One of these, Joshua De Penning, was therefore deputed to fill in the area between Riddell's work and earlier triangulation in Mysore, and from the east coast to the central arc.

Lambton returned to Adoni during 1812 to continue his computations and early in 1813 De Penning started triangulation down to the west coast, closing on a base-line which he measured near Honāvar in January 1814. At the end of 1813, after a visit to the Resident at Hyderābād, and with the full approval of the Nizām, Lambton extended the great arc northwards into the Nizām's territories, and carried his triangles beyond Bīdar, near parallel 18°, where he measured a new base-line and took astronomical observations. In March 1815 he then moved into Hyderābād to work up results.

Between 1802 and 1815 Lambton had covered the whole peninsula south of the Kistna, with the exception of a few small areas along the Western Ghāts, with a network of triangles, braced by main cross belts. He had fixed the geographical position of several thousand prominent points, and had compiled a general map of the southern peninsula, south of Mysore. He had observed an arc of the meridian stretching from Cape Comorin to parallel 18°, the longest geodetic arc ever measured so close to the equator ; he had computed his results, and published them with such explanations and discussions that proclaimed to the whole scientific world that a survey was proceeding in India that would yield geodetic results of the very highest importance to science.

UPPER INDIA

Thanks to Rennell's surveys of the Company's settled districts, there was so little call for new surveys in Bengal and Bihār that the Surveyor General's small staff of regular assistants at Calcutta had been diverted to other work, and in 1801 was abolished altogether. The Surveyor General, Robert Colebrooke, was occupied in the familiar task of compiling a new map of India, and in producing manuscript

copies of any particular area that might be called for; he had one officer surveying the immediate neighbourhood of Calcutta for police purposes, and another surveying the eastern Sundarbans on behalf of the salt department.

At the end of 1801 the new settlement with Oudh, under which Rohilkhand, Gorakhpur, and other districts, were surrendered to the Company in return for military protection, entailed a survey of new boundaries; before this was completed the whole energies of the Presidency were diverted to the war against the Marāthas. Till the close of the war in 1806, the Surveyor General was left single-handed, except for a few draughtsmen, to cope with the constant demand for maps of the fighting areas, and the stream of route surveys which flowed into the office, mostly from inexperienced regimental officers attracted by the monthly survey allowance.

Amongst the useful surveyors of the war was James Blunt, who had won renown by his survey from Chunār to Rājahmundry in 1795, and, as engineer with Harcourt's force in Orissa, now produced a valuable map of Cuttack district. Newcomers included Frederick Sackville who did good work in Bundelkhand between 1805 and 1809, and Francis White, whose work round Delhi and to the west broke entirely new ground. In 1806 both Sackville and White were appointed to full survey allowances under the professional orders of the Surveyor General and the local control of the civil commissioners. Further afield, Lloyd and Tod, with Residents' escorts at Nāgpur and with Sindhia, were both encouraged to collect all the geographical information they could.

The enormous expense of the war had crippled the finances of the Company; the pay of the army was five months in arrears; and it is no wonder that the marine survey of the Orissa coast had to be closed down, and that Government was loth to appoint other surveyors. The only way that Colebrooke could get Rohilkhand surveyed was by obtaining Government permission to go up country and take the field himself, which he did in 1807. He started by surveying, as far as his boats could reach, the great rivers of Oudh and Gorakhpur, the Gogra, the Sarju, and the Rapti. He then went up the Ganges to Cawnpore where he left his boats, and proceeded by land through Lucknow to Bareilly, whence he worked up to the gorge where the Sarju breaks out of the mountains, and then on through Rohilkhand to Meerut and Delhi, which he reached in March 1808.

He had long cherished a scheme for exploring the Ganges above Hardwār, but his health broke down, and it fell to Webb, commanding his escort, who had already proved himself a capable surveyor, to carry out this expedition. Webb led a small party up the Bhāgīrathi to within a few marches of Gangotri, but was prevented from proceeding further by the difficult nature of the road, though an Indian *munshi* of his party succeeded in pushing on to some three miles beyond the sacred source. Webb then ascended the Alaknanda, reached the temple of Badrīnāth, but on his return was arrested by the Nepalese, and had the greatest difficulty in getting his party safely back to join Colebrooke at Bareilly on June 30th. Colebrooke was now very ill, and set out for Calcutta by river, but his strength was rapidly slipping away, and he died when his boats reached Bhāgalpur.

Garstin succeeded as Surveyor General, and more money gradually became available for survey of the Company's new territories and long frontiers. Webb was appointed to survey Oudh and Gorakhpur, but early in 1812 had to take leave to England on medical certificate. Early in 1813 a special commissioner was appointed to investigate encroachments by the Nepalese into British lands along the northern frontiers, and at his request Pickersgill was appointed to survey the disputed areas. Pickersgill's party had many exciting adventures and narrowly escaped being cut up by Nepalese gangs on more than one occasion. He continued survey till the close of the war in 1816, and distinguished himself for leadership and enterprise.

By 1809 Sackville had completed the survey of as much of Bundelkhand as political considerations would allow, and was then brought down to survey Orissa, or rather the area covered by Balasore, Cuttack, and Puri, for he was not expected

to enter the hills. Opportunity was taken to attach several young engineer officers to him for training. After completing the survey in 1812 he took over construction of the road to Puri, the location of which had indeed been one the main objects of the survey.

Early in 1812, in response to a military demand for maps of the southern frontiers of Chota Nāgpur and Mirzāpur to provide against possible incursions by restless *pindāri* marauders, the Surveyor General obtained the appointment of Smyth and Crawford, each of whom was allowed an assistant. Both were called away during 1813, and their places taken by Raper and Robert Smith, who in their turn were withdrawn at the outbreak of the Nepāl war.

After the withdrawal of Sackville from Bundelkhand, William Morrieson was employed for a short time on the survey of Colonel Martindell's marches, and in 1813 the Commander-in-Chief asked for a regular survey of the southern borders which James Franklin took more than five years to complete.

In 1811 White, whose survey of the Sikh country had been suspended since an assault by Sikh marauders near Bhatinda, was appointed to survey the upper *doāb* from Fatehgarh to Meerut and Sahāranpur. On his withdrawal on account of ill-health, the work was taken over by Hodgson, a most enthusiastic and capable surveyor, who took his survey into the Dehra Dūn and surrounding foot-hills, which were still under Gurkha occupation.

Hodgson was then called down to Calcutta to prepare for an extensive survey from Hardwār to Bengal with the special object of sketching in the mountains and their rivers, and fixing the exact positions of the snowy peaks visible from the plains. Crawford, who succeeded as Surveyor General early in 1813, had first observed peaks of the Himālayan range when with the mission to Nepāl in 1801–2, and had continued his observations during a survey from Bihār to Rohilkhand in 1804–5. Colebrooke, the Surveyor General, had been intensely interested in the height of these peaks, and both he and Webb had taken observations during their surveys of 1807–8. Webb, and then Blake, had taken more observations from the plains of Gorakhpur, and Henry Colebrooke, the civilian, wrote up an interesting paper on the subject, that was published in *Asiatic Researches* and attracted much attention in England. The outbreak of the Nepāl war prevented Hodgson's survey from being carried out, and he was attached to the Dinapore column on the Nepāl frontier without, however, having much opportunity of useful survey. At the close of the war he was appointed to survey the Himālayan districts of Sirmūr and Garhwāl that had been released from the Gurkhas.

The most important survey in Lower Bengal was that of the Sundarbans by the Morrieson brothers between 1811 and 1814. The major creeks and the sea-face had been surveyed some 40 years before by John Ritchie, and the area towards the Meghna and across to the Chittagong coast by Thomas Robertson during 1802–4. In 1811 William Morrieson was deputed to survey the area between the Hooghly and Raymangal rivers, where the villagers had cleared wide stretches of jungle and had extended cultivation for which they paid no revenues; the creeks, moreover, gave shelter to smugglers and dacoits. Morrieson was joined by his brother Hugh in 1813, and was himself called away to other duty the following year. The survey was suspended by the Nepāl war, but taken up again later by Hugh Morrieson.

In contrast to the Madras surveys of this period, it may be noticed that there was no regular plan of survey operations in Bengal. They were taken up spasmodically as the need for any particular area became necessary. As a rule it was considered sufficient to send a single surveyor to each task, though occasionally he was given an assistant who was often completely untrained. When a surveyor went sick, or was called away to other duties, the survey was either completely abandoned, or another surveyor had to be found. There was no co-ordination between the different surveyors, and no regular junction between their work, though copies of earlier surveys were sometimes provided. Each area was surveyed as a separate entity, and was incorporated into the general map after reaching the Surveyor General's office.

The normal method of survey was by theodolite traverse, though in hilly areas the more experienced surveyors strengthened their work by bearings to distant points. Crawford had observed a few triangles whilst in Nepāl to assist his observations of the snowy peaks, but the only other attempt at regular triangulation was by Franklin in Bundelkhand, and even then he sent in no chart or computations, and was probably content with a graphic protraction. It was only in the southern peninsula that triangulation had been found generally practicable.

BOMBAY

Charles Reynolds continued as Surveyor General, Bombay, till his retirement in 1807, and was wholly occupied with the completion of his great map for which, during the last five or six years, he had three officers to assist him. The revision and extension of this map was continued by his successor Williams for many years after.

The first important field survey to be undertaken was that of the frontiers of Gujarāt, which was urged by John Malcolm as a precaution against possible invasion by Napoleon. Williams and three other officers spent the greater part of 1809 and 1810 in surveying and compiling a respectable map. They were not allowed into Cutch, and the greater part of Kathiawar had been surveyed during military expeditions of 1807–9. Their survey was brought to an early close by the passing of the scare, and by the extreme reluctance of the Bombay Government to spend a rupee more than was necessary.

Malcolm's chief responsibility was to conduct a mission of friendship and exploration to Persia, in pursuit of which he despatched a number of intrepid young officers on various hazardous journeys. Grant had an adventurous time in Makrān, whilst Christie and Pottinger travelled further north through Seistān and Herāt; all in disguise. Later on, Grant and Fotheringham were murdered by Kurd tribesmen in the hills between Irāq and Persia.

Malcolm himself started from Bombay in January 1810, but had been preceded by Harford Jones, sent out from England, with whose mission went James Sutherland, the Surveyor General's senior assistant. Sutherland spent nearly two years in Persia, and carried out a lot of useful survey without having to make any effort at concealment.

For the next sixty years the maps of Baluchistān and Persia rested entirely on the work of these few surveyors.

REVENUE SURVEYS

An account was given in our first volume of the attempts made in Bengal to use indigenous methods for land measurement and assessment of revenues, and of the decision made in 1793 to accept the assessment of that period as permanent for all time. It was pointed out that difficulties followed from the lack of precise knowledge of the exact areas covered by this permanent settlement, and provision had to be made for the assessment of waste lands newly reclaimed. This problem became particularly important in the Sundarbans and, after Morrieson had made some progress in his general survey, it was arranged in 1814 to start a detailed survey for revenue purposes under the control of the civil authorities.

There was much discussion as to whether to introduce a permanent settlement into the upper provinces which had been acquired, some by cession from Oudh, and some by conquest from the Marāthas. It was successfully argued that the knowledge of revenue conditions in those provinces was utterly inadequate to form any basis for such settlement, and local officers were left to make such short-term settlements as appeared suitable. The first attempt at professional survey was made in the upper *doāb*, where Gerard was employed from 1814 in making a detailed survey of the cultivated lands of Sahāranpur.

In Madras the first tendency was to form a permanent settlement with the leading *zamīndars*, though in many areas there were no such landholders to deal with. Alexander Read had already shewn in Salem and Bāramahāl what successful results could be obtained by a detailed settlement made direct with the *ryots* for a period of years, the measurement of the fields being carried out by *amīns*, working under Indian supervisors and European revenue officers.

Thomas Munro, who had been one of Read's assistants, carried this system still further during his charge of the Ceded Districts between 1801 and 1807. His survey and settlement was a masterpiece of organization, and the regulations which he drew up long remained the standard guide for Madras revenue surveys, and were eventually introduced into Bombay with but little change.

It was on the Bombay side that the first successful revenue surveys were carried out by European methods. In 1810 a survey of fruit plantations was put in hand, which was taken over in 1812 by Dickinson as Revenue Surveyor. During the next eight years he completed an accurate land survey of the whole of Bombay and Salsette islands. Besides the exact measurements, some of which was carried out by Indian measurers, Dickinson and his assistants, all military officers, compiled a complete register of land-tenures, and a classification and valuation of crops. His survey was based on sound triangulation and traverse, and his maps and records remained the standard authority for very many years.

In 1810 the Directors asked for a complete revenue survey of Broach District. An experimental survey of one village was first made by Williams in 1811, and he and the Collector were then commissioned to continue the survey over the whole district, which they completed with military and civil assistants early in 1816. The final records, besides showing all topographical features, contained plans of the lands and boundaries of every village, with the position and measurement of every field and full particulars of every land-holder.

CONCLUSION

We have now followed the surveys of India through another stage. In our first volume we began by sketching the early efforts of navigators, travellers, and missionaries, up to the start of surveys of precision, which began in 1761 with Plaisted's survey of the coasts of Chittagong and Cameron's survey of the Twenty-four Parganas. Then followed Rennell's appointment, first in 1764 to survey the Ganges River, then in 1765 to survey the whole of Bengal, and finally in 1767 to be Surveyor General of Bengal. We watched him complete his great survey of Bengal and Bihār, and then return to England to compile his *Map of Hindoostan*.

We have seen one Surveyor General follow another in Bengal, and the enterprise and devotion of the surveyors of the three Presidencies, eagerly pushing into the unknown interior, gathering all the geographical knowledge they could ; some urged by the spirit of adventure and zeal for investigating the unknown, a few with a feeling for order and precision. We have followed the unwearied efforts of Reynolds, the pioneer explorer of the Marātha country, labouring for years at a map which was never published. There was the succession of devoted men in Madras ; Robert Kelly with his orderly series of degree sheets ; Michael Topping, founder of the Madras observatory and surveying school, and first advocate of a continuous series of triangles that should spread "throughout India" ; and now Colin Mackenzie, with his disciplined mind, striving after a uniform system of survey that should furnish maps and statistics to meet the needs of both soldier and civilian.

We have seen the baffling problem of land revenue survey made the subject of futile experiments in Bengal, but brought to a practical solution in Madras by Read and Munro, by a system which proved in the long run to be subject to human frailty, and entirely dependent on the standard of supervision. We have seen, on the other hand, the excellent results of detailed land survey carried out in Bombay

under a staff of European officers, burdened, however, with the fatal defect of enormous expense.

In all these surveys the only signs of co-ordinated action appear in Rennell's survey of Bengal, Mackenzie's topographical surveys, and the surveys of the Military Institution in Madras. For the rest, we find no scheme ever put into action for a continuous progressive survey of the whole country, till we turn to Lambton. Surveys were put in hand, either to meet some urgent call, or as ancillary to some political or military expedition. No Presidency was interested in making a single plan for co-ordinating the scattered surveys of so huge a continent as India. Reuben Burrow's astronomical survey was the only effort made in this direction during the 18th century, but though originally intended to include the whole coast-line of India, it only ran through the Ganges valley and up the Brahmaputra to the Assam frontier.

The debt that Indian geography owes to William Lambton can hardly be adequately expressed, for without him it is difficult to see how the boon of a great trigonometrical survey would have reached India. Officers of the East India Company's service, who came to India before they were twenty years of age, were hardly likely to have had the necessary knowledge and training, let alone the conviction and force of purpose, to carry through so great an innovation. The presence in India of a man of Lambton's genius and character, knowledge of mathematics, and interest in geodesy, was entirely fortuitous. So also was his service in Mysore with the Grand Army, which impressed on him the vastness of an area that was practically unknown to geography, and the futility of trying to survey it without the aid of geodetic science. Though he was fortunate to find men of position, Arthur Wellesley, William Petrie, and Andrew Scott, who could appreciate his purpose, it was his own mastery of the subject, and the ability with which he carried it into execution and discussed its results, that convinced the Governments, both of Madras and Fort William, and also the Directors in London, that his plan was essential for the correct survey and mapping of India.

Lambton was geographer as well as geodesist, and from the commencement of his work tried to combine his geodetic work with a general survey of the country. Right up to 1818, when his survey was first officially designated the Great Trigonometrical Survey of India, he was officially addressed, and always signed himself, as "on General Survey".

And now to close this stage in our narrative we come to the decision made by the Directors that it was wasteful to maintain three separate and independent Surveyor Generals, each with his own department. Mackenzie was appointed Surveyor General of India from 1st May 1815, with the special task of controlling the surveys of all three presidencies, and compiling all the general maps that might be required, but without authority over Lambton's survey.

As it turned out, the change did not at once produce the good results that were anticipated, though it certainly effected some economy of expenditure. Whilst surveys of the south peninsula progressed in an orderly manner on the secure foundation of Lambton's survey, those of Upper India continued to be spasmodic and disconnected until the Great Trigonometrical Survey was brought to the Himālaya Mountains by the labour and genius of George Everest.

CHAPTER II

BENGAL & ORISSA

Marine Surveys, 1802–5 — Calcutta to Chittagong, 1801–4 — The Sundarbans, 1811–5 — Calcutta — District Surveys, 1812–5 — Ganges–Hooghly passage, 1801–12 — The Ganges Highway, 1801–7 — Orissa, 1803–13.

WE closed the narrative of the Bengal surveys of the 18th century with an account of Upjohn's survey of the Chittagong coast, and Government's orders that further surveys required by the Marine Board should receive special authority [I, 65–6].

The Surveyor General was at this time equally responsible for marine as for land surveys, and in 1802 was collecting coastal charts of "Cambodia and Cochin China" and other eastern lands, making copies for Government and the Directors, and asking that they should be engraved in England[1]. He further suggested

that a survey of the Coasts of Aracan, Pegu, Martaban, and Mergui, with the Islands bordering thereon, might easily be performed in the fair season by means of the two Gun Vessels at present stationed on the Coast of Chittagong. ...

Should Government approve, ... I would...recommend that the Survey be ordered to commence about the middle of October ; that an officer properly qualified for the service be appointed to perform it, and that two European Assistants be ordered to attend him[2].

His proposal was approved and, not being able to secure the services of McCarthy who had assisted Upjohn [I, 65, 394], he recommended another sailor, Robert Knox ;

I have examined Mr. Knox respecting his ability to undertake the Survey of the Coast of Aracan, and...I think him sufficiently qualified to be employed upon that, or any other, Marine Survey. As however he is hitherto totally unprovided with the necessary Instruments and Books, and the Season proper for performing a Survey so extensive...would be far advanced before the vessels could be ready for sea, ... it might be expedient for the present to employ Mr. Knox in surveying the Outlets of the Ganges and Sunderbunds, in which also...Sundeepa[3], hitherto but imperfectly known, might be included, and to defer that of the Aracan Coast until next year. ...

Such a survey would be useful towards completing that which has been already ordered of the Sunderbunds and Salt Agency Districts [13], as it could otherwise hardly be expected that a single Engineer Officer would be able to finish a work so extensive, and upon such a scale, as would render it sufficiently minute and descriptive under a period of several years. ...

I take the liberty of proposing Mr. A. McKay, who is well grounded in Mathematical knowledge, and Mr. Chas. Geo. Nicholls, an expert Draftsman, to accompany Mr. Knox as Assistants, ... and I further beg leave to suggest the under mentioned salaries ; ... Mr. Knox, S. Rs. 350 ; Mr. McKay, 250 ; Mr. Nicholls, 200.

A further sum of about one thousand Rupees may be necessary for the purchase of three sextants, and other Instruments as are not procurable from the Marine or Military stores[4].

Early in January 1803, Knox set out in command of "the Honorable Company's Gun Vessel Scourge" to survey the islands at the mouth of the Ganges[5], and the Surveyor General heard from him two months later, reporting

the success of the expedition this far, and stating that he supposed it would require about fifteen weeks to finish the Survey. ...

Mr. Jeremiah McCarthy, who formerly assisted the late Mr. Upjohn in surveying the Coast of Chittagong, is returned to the Presidency. Being desirous of engaging once more in that Line

[1] DDn. 67 (106), 29–5–02, etc. [2] ib. (110), 30–6–02; marine charts, MRIO. folios 100–5. [3] Sandwip, 79 N/6. [4] ib. (155), 13–11–02. [5] Fdbks. DDn. 48 & 77 ; chart, MRIO. 101 (7).

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Reduced for Sea Service for the Marine Board

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— NEW —

PLAIN CHART

Surveyed and constructed by R. Knox. &

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In the Years 1804–1805

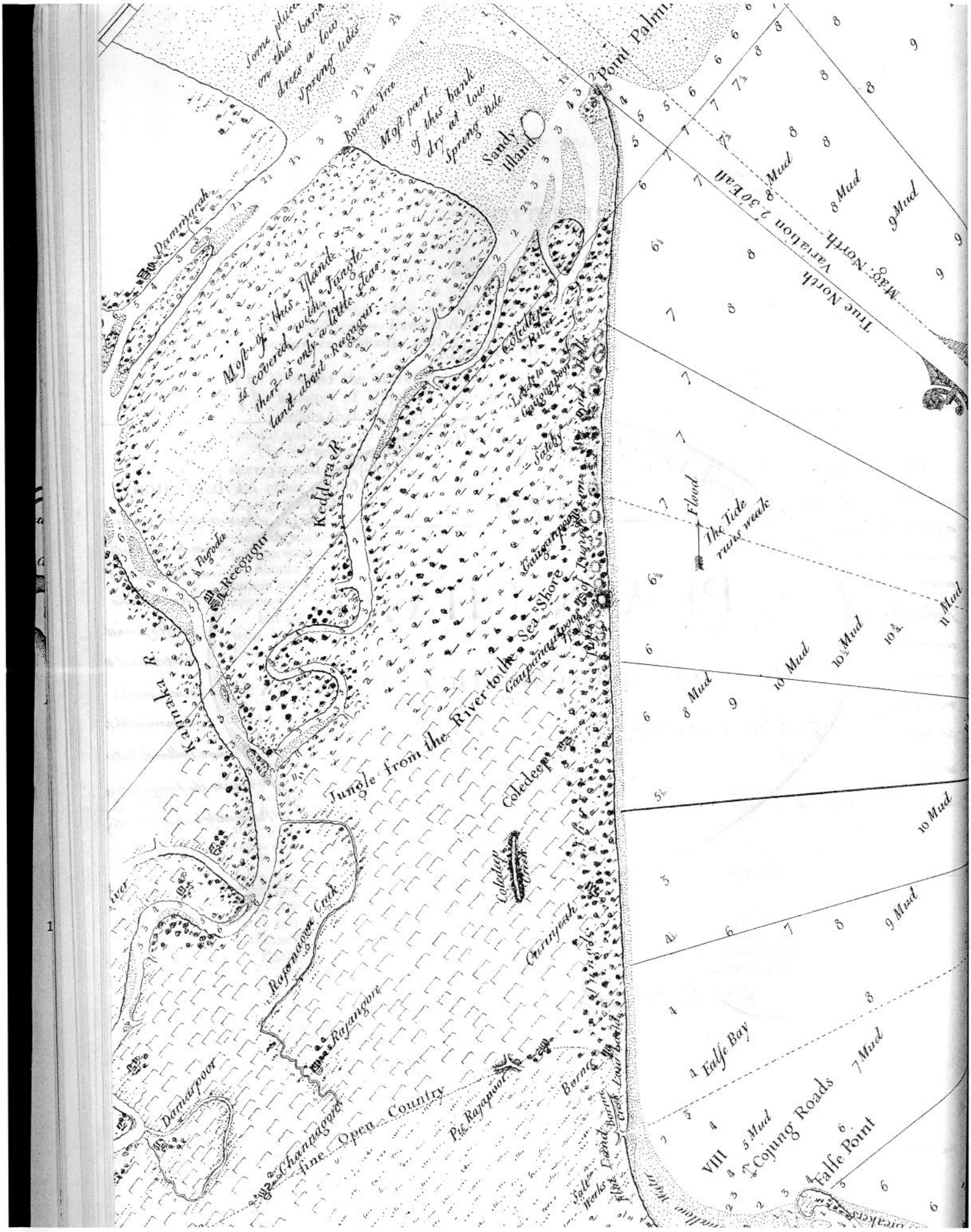
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by R. Knox

Marine Surveyor

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Some places on this bank dries a low spring tides
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Most of this Island is covered with Jungle there is only a little clear land about Reegagur
Dammarah
Coledeep River
Safety
Kedleree R.
A Pagoda
Reegagur
Flood
The Tide runs weak
True North
Mags. North
Variation 2 30 East
Mud
Kannaka R.
Jungle from the River to the Sea Shore
Coledeep
Rajamoone Creek
Coledeep Creek
Curruyash
Damarpoor
Rajangore
Pte. Rajapoor
Channagore
fine Open Country
Borne
Salt Works
False Bay
VIII
Cojung Roads
False Point

of Service, he has proposed to me to Survey and ascertain the Latitude and Longitude of Point Palmyras[1] by celestial Observations to be taken on shore, provided he could obtain the Command of one of the Gun Vessels, with a tent and a small party of Sepoys to protect him from the Natives of that Coast who are extremely savage.

With respect to the Longitude of Point Palmyras, it having never been determined but by Lunar Observations taken at a distance from the shore, the more accurate ascertainment of it by Eclipses of Jupiter's Satellites would be very desirable[2]. ... The season is now favourable for making these Observations, and...Mr. McCarthy could be supplied with a Telescope from this Office for that purpose. As correspondent Observations of the Satellites of Jupiter are continually being made at the Madras Observatory and by myself at the Presidency with Telescopes of the same dimensions and magnifying powers, the Longitudes of the Point could thus be obtained with the greatest accuracy [I, 168, 180–1].

Mr. McCarthy could afterwards be employed in surveying the Sands and Sea Reefs between Hidgellee[3] and Saugor, and...might be directed to proceed with Mr. Knox on the commencement of the ensuing N. E. Monsoon, to survey the Coast of Aracan and Eastern side of the Bay. ...

The deputation of Mr. McCarthy to Point Palmyras might embrace another object of the highest importance, which is that of erection of a Light House on the Point [24][4].

The survey of Point Palmyras was postponed for fear of offending the Marāthas so McCarthy was employed on surveying the lower Hooghly[5]. In October, after the occupation of Orissa [23], it was suggested that he and Knox

would now be very useful in exploring the Western side of the Bay between Ballasore and Jaggernath[6], and surveying Point Palmyras...and the Mouths of the Mahanuddee. ... We are not in possession of any good Survey of that Coast, the difficulties of landing upon it having formerly obstructed any attempts to explore it[7].

McCarthy and McKay were sent off to Balasore in the *Scourge*, whilst Knox and Nicholls followed with orders that,

as soon as the Tiger Gun Vessel shall be ready for Sea, you will proceed by that Vessel to Ballasore Roads, and thence to Point Palmyras and Goojung Bay[8]. You will find the Principal Outlet of the Mahunuddy River...and will sail up the River as far as it may be practicable for the Vessel to go. ...

You will notify your arrival to Lt. Colonel Harcourt, the Commanding Officer at Cuttack, and receive such further Orders...as he may be pleased to give you. Having accomplished this part of the Survey you will...Survey the Coast and different outlets of the Mahanuddee between Jaggernaut and Point Palmyras[9] [pl. 4].

Neither Knox nor McCarthy being government servants, the Surveyor General enquired which should take command ;

Mr. McCarthy is the oldest Surveyor, but Mr. Knox was the first who obtained the Command of a Gun Boat. They are both at present exactly on a Par with respect to Pay, and having each the Command of one of the Gun Vessels[10]. ...

I understood from the Governor General's Military Secretary verbally that the question of Command, in case of the two vessels meeting or acting together, has been decided by Lord Wellesley [in favour of Knox][11].

McCarthy now visited Point Palmyras, made a survey, observed its longitude, and drafted sailing instructions[12]. Both vessels visited Calcutta in June 1804 for repairs, and McCarthy returned in August,

the Government having directed you to resume the Survey of the Coast of Orissa from Point Palmyras to Manickpatam[13]. ... As the survey will extend to...the Outlet of the Chilka Lake, it is very desirable that you should...endeavour to explore the passage into that Lake, with a view to ascertain whether by deepening the Channel...between it and the Sea, it might hereafter serve as an Harbour for large Ships [I, 101 ; II, 12].

As the Country surrounding the Chilka Lake had heretofore been mostly in possession of the Mahrattas, no correct Survey of it has ever been obtained [12]. It therefore becomes an object now, to explore its Northern and Western Shores, as well as the numerous Islands which it contains, for Geographical as well as for any eventual nautical purposes which the discovery of its fitness for an Harbour might suggest[14].

[1] 73 L/14. [2] Blunt had not been able to make visit proposed in 1795 [I, 167]. [3] Right bank of lower Hooghly. [4] DDn. 67 (184) 10–3–03 ; nothing had come of Ritchie's proposals for such a lighthouse [I, 45]. [5] BPC. 2–6–03 (13). [6] or Puri, 73 L/12. [7] ib. (279), 24–10–03. [8] Kujang, 73 L/12. [9] DDn. 67 (284), 21–11–03. [10] ib. (287), 26–11–03. [11] ib. (310), 9–4–04. [12] MRIO. 161 (3, 4). [13] Mānikpātna, 74 E/10, at the mouth of Chilka Lake on old maps. [14] ib. (332), 14–8–04.

Knox followed later and reported on December 13th that

the Tiger, with two Store vessels, arrived safe in Kannaka River[1] on the 1st inst., and proceeded up it about 30 miles, where all the stores was delivered...to proceed to Cuttack. The Kannaka Rajah is very much displeased at our passage through his Dominions ; the manner and hostile appearance of the Natives is quite different since last May[2].

Whilst survey was being extended southwards towards the Chilka Lake after the monsoon of 1805, it was closed down as a measure of retrenchment [5, 112]; the surveyors were discharged, except McCarthy who was sent to Prince of Wales Island to survey Penang Harbour[3]. The 'gun vessels' were "delivered over to the Master Attendant to be laid up[4]" and the Surveyor General records that,

the Marine Surveys having been discontinued by order of Government, a few of the lower branches of the Mahanuddy, and the Chilka Lake, remain yet to be explored, but these may be surveyed at any future period as conveniently by an Engineer officer, by land or in boats, as they could have been done by the Marine Surveyors[5].

A survey of the lake was made by Charles Weston[6] in 1812.

In addition to Knox's fieldbooks[7], there are still preserved at Calcutta a number of charts by him and McCarthy, mostly on scales of one or four inches to a mile[8]; [pl. 4] the scale of Ritchie's surveys had been 12 inches to a degree, or 5 miles to an inch [I, 16–7, 224]. There is also preserved a large scale survey of the Sand-heads at the mouth of the Hooghly by McCarthy[9], which ten years later was " from the alterations in the Channels...of no use, except as a curious record "[10].

Surveys of the Hooghly were normally carried out by the pilots ;

A Survey of the River Hooghly, from Calcutta to the Roads, is made twice a year by one of the Master Attendant's Deputies, and three or four of the Branch Pilots, and Mr. Wade, one of the Branch Pilots, has lately made a very particular Survey of the River[11]. ...

No plan, however accurately taken, of the Navigation in and about the entrance of this River, should be depended upon for any period, by reason of the very frequent alterations in the various Channels and the Sands shifting[12].

For his surveys of 1798 [I, 51] Wade was given a reward of Rs. 3,000, whereas for those of 1801 and 1802 he received Rs. 2,000 only ; "the plans now presented being a work of less labour and skill than the set of Charts before submitted "[13].

In 1809 a marine survey department was established in Bengal with John Wales as Marine Surveyor [296].

CALCUTTA TO CHITTAGONG, 1801–4

On the death of Upjohn in 1800, the only survey left in progress was that of Thomas Wood with the army in Oudh [I, 58]. It was not long, however, before fresh demands came in, and at the end of the year the Surveyor General submitted

a Map of the Country round Calcutta, which I have prepared for the use of the Superintendent General of Police [5, 268][14]. I lament that the Materials which I employed for this purpose have not enabled me to render the Map more complete ; and...as the Country round Calcutta, particularly to the Eastward & Westward, does not appear from any Plans in this Office to have ever been very minutely surveyed, a new Topographical Survey of such parts as are least known might enable me to furnish a more ample and perfect map for the use of the Chief Magistrate of Police, or any other purpose for which Government might want it. Such a Survey could be performed in short excursions from the Presidency by any Officer properly qualified[15].

He was given George Fleming, of the Engineers, and gave him detailed directions [199] :

[1] or Brāhmani R. [2] BPC. 3–1–05 (12). [3] ib. 13–3–06 (14). [4] ib. 6–2–06 (32). [5] DDn. 67, 12–3–06. [6] Charles Thomas Gustavus Weston, 14th Ben. NI., Ens. 1807 ; d. 27–5–28 ; Map, MRIO. 172 (2). [7] DDn. 48, 76, 77. [8] MRIO. 42 (27–9) ; 57 (25) ; 100 (17, 24) ; 101 (38) ; 102 (26) ; 104 (3–12) ; 105 (8). 161 (23) ; 166 (14) etc. [9] MRIO. 165 (18–21) ; DDn. 67 (207). [10] DDn. 128 (16), 12–4–11 ; chart, MRIO. 104 (43–4) ; 105 (1, 2). [11] From Marine Board, BPC. 21–4–03. [12] From the Master Attendant, BPC. 12–5–03 (21). [13] ib. 26–5–03 (16). [14] Map, MRIO. 52 (2, 3). [15] DDn. 67 (25–6), 26–12–1800.

This Survey being intended to be performed by Excursions from the Presidency, ... I should from time to time direct you in the Track you are to follow, and point out the particular objects to be attended to on each excursion.

On the first of the ensuing Month, or so soon as you are ready, you will commence the Survey from Chitpoor Bridge at the Northern extremity of the Town of Calcutta, and proceed along the high Military Road to Barrackpour Cantonment, noting the Villages, Tanks, Nullahs, Bridges, Topes[1], Milestones, and every other requisite to a Topographical Survey. From Barrackpour you will proceed in an Easterly direction to Neelgunge[2], when the same degree of attention to all the minutiae of the Route will be requisite.

It will be necessary here to observe the limit between the Calcutta and Anorpour Purgunnahs, and the same must afterwards be done in crossing all the divisions of Purgunnahs or Districts as you proceed.

From Neelgunge your Route will lay through the following Places ; ... Bungaong on the Issamutty River[3] ; ... thence S. Easterly to Badooriah on the Jaboona River, where a salt Choky[4] is stationed. From this place you will return in a Westerly direction, through Gopalpour (where Salt Golahs[5] are situated) to...Calcutta[6].

Fleming's first excursion, surveying about a mile on each side of his route, was completed in a few weeks. At the end of the rains he was sent out again, and by January 1802 had covered a wide area both west and east of the Hooghly, well controlled by "celestial observations"[7], the Surveyor General reporting that the routes already surveyed by Captain Fleming, in addition to such as he may be ordered to survey before the ensuing rainy season, will...be sufficient to complete the Maps (as far as may be wanted for any common Geographical purpose) of the Country round Calcutta, to the extent of forty or fifty Miles[8].

Should it be the intention of Government, after that period, to order the survey to be extended to the Salt districts and Sunderbunds, which are yet but very imperfectly known, I would beg leave to propose that an able assistant be appointed to accompany Captain Fleming for that purpose[9].

Fleming extended his survey eastward, but fell ill and was relieved by Thomas Robertson [I, 382] who was given fresh instructions ;

The Sunderbunds being at present but imperfectly known, and the several Salt Chokies and Golahs, or places where salt is made, not being hitherto laid down in any general plan, it will be necessary that you should be particularly careful to mark all such places, and to distinguish to which of the Salt Agencies they respectively belong.

You will...commence by surveying the Salt-water Lakes to the Eastward of Calcutta [I, 12], and...by the way of Tardah to the Sunderbunds. You will then examine all the Creeks or Inlets on your left as far as it may be practicable to go, and...lay down all the villages, salt works, golahs, and chokees, which may be found on their banks. ... The principal of these rivers and creeks are the Ooriaparah creeks, the...Callagatchee and Nowye Rivers, none of which have ever been laid down accurately in our maps.

Having surveyed these, be pleased to pursue your journey to the eastward...and, having entered the Jaboona River, to proceed by the new cut made by Mr. Goodlad[10] to Teecha. From thence...you will continue the survey to Bakergunge, Luckipoor[11], and Chittagong.

Having surveyed the Salt Agency District of Chittagong so far down the coast as to connect the survey with that which you formerly took of a part of that coast [I, 59], you will return to the Presidency by such routes as I may hereafter point out.

In conducting this survey it will be necessary that you should occasionally leave your boats and travel by land, particularly in the Comillah[12] and Chittagong Districts[13].

Some time later the Surveyor General wrote again ;

The Inland Parts of the Chittagong District are sufficiently well known, as far as the Hills at least, so you need not make any Land Trips, which at this time of the year would prove extremely disagreable, but if you can get...any tolerable information as to the situations of the principal...Salt works...it will answer our purpose.

The Chittagong River and Coast as far as the S. end of Mascal Island has been very well surveyed already [I, 65–6], so you need not trouble yourself with that part, but if on your return (which on account of the approaching Heats and Norwesters, as well as strong Southerly

[1] Groves of Trees. [2] 79 B/5. [3] Bangaon, 79 A/16; Ichāmati R. [4] *choki* or outpost. [5] *gola*, or round store shed. [6] DDn. 67 (37), 24–4–01. [7] ib. (57), 28–10–01. [8] Original surveys, 2 inches to a mile ; MRIO. 50 (4–105) ; compilation, 2 m. to inch, MRIO. 48 (2) ; printed copy, about 1860, IRD. Lib. [9] DDn. 67 (68), 27–1–02. [10] Richard Goodlad, BCS. 1771; Salt Agent, 24-Parganas, 1790–1800. [11] Bakarganj, 79 J/6; Lakshmipur, 79 J/13. [12] 79 M/3. [13] DDn. 67 (168), 6–12–02; BMC. 11–12–02 (57).

winds, you should not delay), you can improve the Chart of the Coast between Chittagong and Luckypoor, it will be useful.

Any navigable Inlets that you could explore would also contribute to the perfection of the intended Map, particularly as some of the principal Salt Works etc. are probably to be met with on the Banks of such Rivers or Inlets. ...

At any rate it is desirable to have as complete a Chart of Inland Navigation as possible, *connected* with the Chart of the Salt Agencies, so you need not hesitate about performing this part of you find the weather will permit you. You could then return by the Jellinghy[1] and Hooghly to Calcutta for the rainy Season[2] [20, 22].

The Surveyor General reported at the same time that Robertson
has surveyed and delivered to me his Plans of several new Channels and Rivers of the Sunderbunds which had not previously been explored[3], but that from the extreme heat and inclemency of the weather during a considerable portion of the time he has been employed, this work has not advanced so rapidly as I could have wished, and much remains yet to be done to complete it[4].

He later reported that Robertson
was on Survey up to 27th June [1804], ... but was employed protracting and finishing his Plans until 3rd of October, which time he received Orders to join the Army in the Field [57][5]. ... Enough, however, had been done by him previous to his departure, to enable me to commence upon the construction of a very large Chart of the Sunderbunds, but which for want of an Assistant possessing the requisite scientific knowledge I have not been able to continue[6].

THE SUNDARBANS, 1811–15

The Sundarbans cover an area lying between the Hooghly on the west and the Meghna on the east, a distance of about 200 miles, and extend from the sea face to about 60 miles inland. They have been formed by the continual deposit of silt at the mouths of the Ganges, and are cut up by a network of tidal creeks between the main outlets. The whole unreclaimed area is reached by the highest tides, and covered by dense forest growth, the principal tree being the *sundra*.

Reclamation is carried out by the construction of embankments round small plots of land, and good crops are obtained about five years after exclusion of tidal water. Under peaceful and settled conditions cultivation was extending steadily, and at the end of 1810 the Surveyor General sent to Government
two copies of the Survey ordered for the Magistrates of Nuddea and Jessore. It is to be greatly regretted that there are no materials to carry them lower into a part of the country which is hourly becoming of importance ; it has never been surveyed, having been always considered as inaccessible on account of the Tigers, but I have reason to believe that it is now well inhabited, the Banks of the Rivers only being skreened by a Belt of Jungle, to deceive & prevent the inhabitants from paying rent to Government[7]. ...

There is reason to consider that several considerable tracts of Land between the Large Rivers are under cultivation, though surrounded with Belts of Jungle, the haunt of Wild Beasts. Within these Woods are fertile Plains that pay no Revenue to Government, but which serve as refuge to many smugglers of salt, and of Dacoits fled from justice. Of the certainty of the fact I speak with diffidence, never having been into that part of the Country, but it appears to me to be a point well Worthy being carefully investigated. ...

I would recommend that Lieut. W. E. Morrieson...should be directed to make a correct Survey of the Principal passages, as far as practicable, for which purpose, as He must unavoidably live in the Boats and cannot make the observations required without them, he be styled Surveyor of Rivers in the Sunderbunds[8] [I, 277 ; II, 6, 327].

He directed Morrieson
to proceed on the Survey of part of the Sunderbunds agreable to the General Orders of the 2nd Instant. ... You will be furnished...with copies of a protraction of the Southern boundary of the Country to be surveyed. ... This drawing is partly taken from the original of Major Thos.

[1] Jalangi R., 78 D/12 to 79 A/7. [2] DDn. 67 (301), 5–3–04. [3] MS. *Survey of the Sunderbunds*, 8 sheets, one-inch scale : MRIO. 42 (8–17) ; MRIO. 164 (17). [4] DDn. 67 (305), 14–3–04. [5] ib. (364), 18–2–05. [6] ib. (366), 12–3–05. [7] DDn. 126 (71), 22–12–10. The banks would be too soaked with sea-water to be fit for cultivation. [8] ib. (78), 28–1–11.

Robertson [13]; ... to it is added a survey by the late Lieut. Colonel Colebrooke, comprehending part of the Jabunah[1] [I, 63]; these lines will point out the extent of your labour to the East and the North. ...

It is desirable that all the Blank spaces in this Map should be carefully filled up on the same Scale, viz. Two miles to one inch. ... The Task allotted to you for this Season does not require so much skill as it exacts industry and attention. ...

You will then proceed by the Koolia River to Henkle Gunge[2], thence up the Jabunah, ... and along the Jabunah Creek to the Hooghly, filling up those spaces not before surveyed as you pass, for which purpose a light tent will be very useful. By measuring the distance across the Isthmus in three or four places, and never returning the same road...you went, you will save yourself much labour, and judge which Country should be surveyed from the Eastern River, or from the Hooghly. ...

When the Field Work of the short season before you is ended, and you come in for the Rains, it will be desirable to have a protraction of the Survey laid down on a projection of the General Map that shall be furnished.

It must be evident that those Gentlemen who are employed to survey the Country, whilst on the Spot, must judge more correctly of the particular Places to be laid down, and of what ought to be omitted in the General Map, than any other person[3]. ... All the information given will be inserted in the name of the Surveyor supplying it, whose fair fame depends on its being accurate. ...

Several objects are to be held in view ; one to have it clearly determined what parts of the Country are now actually under cultivation, and what remains waste. Secondly to show as far as practicable, what has lately been brought under Tillage or gained from the Wilderness. To have the Jungles carefully described, and...to enquire and note on the Map the Species of Wood that is produced, and whether it is large or small. On the Borders of the Woodlands, when you come to a Village, send for the Head Man, and enquire when the Place was first established, and what number of Families it contains ; if He can write ask for a list.

On the spot this requires little Trouble, but may be greatly useful, and is easily expressed in a map. ... Without the appearance of design, enquiry may be made whether the Place is notorious, or not, for Dacoits, and if so a mark will express it, but it would be wrong to give a Place, any more than an Individual, a bad name on slight Grounds. ... The Jabunah was lately infested with Dacoits ; Colonel Colebrooke's accurate Survey [in 1795, I, 63–4 ; II, pl. 19] greatly assisted the Magistrate to dissolve the association, shewing the utility of correct Maps.

The general produce of the Country, whether fruitful or not, should be mentioned, and if large Herds of Cattle are bred, they may be noticed ; whether the country abounds with Game, the Rivers with Fish ; and every Indigo factory may be written in blue, so as to convey in the most concise terms possible useful information[4].

At the same time, George Blane was sent down the Hooghly to survey Sāgar Island ;

A most favourable opportunity of causing the Island of Saugor to be Surveyed now offers, there being a large Party of Birkundasses and of Wood-Cutters employed in clearing away the Jungles to make preparations for the building the Light House ; ... Lieutenant George Rodney Blane of the Engineers is every way well qualified for this Duty. ... He should be considered as a Surveyor of Rivers, and be directed to draw the allowances as such [I, 276 n.1], as he must entirely live upon the water, the danger of Sleeping on Shore being too great[5]. ...

It will be absolutely necessary for him to have Two Vessels of sufficient draught of Water to be Sea Worthy, and Two Bauleahs to attend during the Survey of that Island. ... Their Hire...will not be less than Three Hundred Rupees per month each, and Two attendant Boats sixty, in all 720 Rs. ... The recommendation is reasonable, it being impossible for any one to sleep on Shore, and the Sea runs so high that none but Stout Boats, well manned, can live in it. These Vessels to be independent of the Officer's accommodation, which must be moored in a Creek, or some Place of Safety, to return to when the labour of the Day is over, and to secure a lodging for the night in case of accidents.

I suppose that one month from the time they reach Saugor will be sufficient to complete the Survey[6].

To Blane the Surveyor General writes ;

You will be pleased...to procced to Saugor Island at the mouth of the River Hooghly, and make a very careful and Correct Survey of the whole Island, particularly delineating it,

[1] Jamuna R. 79 B/9 to 14. [2] Hingulganj, 79 B/15 [I, 159]. [3] A sentiment that might well appear in our modern handbooks. [4] DDn. 126 (87), 19–4–11. [5] from the SG.; DDn. 128 (5), 8–3–11. [6] ib. (6) 20–3–11.

laying down the Face of the Country, noting the courses of all Creeks and Water ways, distinguishing Marshes, raised Ground, the Jungles etc., to enable Government to judge of the quantity of Land that may be brought into cultivation ; whenever there may be fresh Water it should be carefully remarked, the size of the Tanks shewn, the nature of the Trees, whether large or small ; as far as in your power to discover the Species they should be mentioned in your Field Book, and in those parts where the Soil can be seen, enquiry should be made as to its qualities and fertility. ... All the Surrounding Waters, their breadth and depth must be shown, as well as every Creek or Channel leading into them. ...

The various species of Wild Beasts seen, & the number, should be mentioned, to enable those who may hereafter be employed to guard against accidents[1].

The same day, he writes to the Adjutant General ;

Government having ordered Lieutenant Morrieson...to survey part of the Sunderbunds, and Lieutenant Blane the Island of Saugor, I request...the necessity there is for both of these Officers being furnished with a Guard of Sepoys. Lieutenant Morrieson will require protection, not only against Wild Beasts, but also to be defended from any attack of the Dacoits and the savage inhabitants of the Waste he is directed to explore, who may be jealous of any enquiry as to the nature of the Country they have for many years been in quiet possession of ; and on Saugor, Lieutenant Blane ought not to advance without a party to drive away Tigers etc., which may make their appearance[2].

Blane completed his survey during May and June 1811, on the scale of 2 inches to a mile, and his plan is preserved at Calcutta, shewing all the creeks in detail, and the division of the islands into "lots", with the name of each lot-holder[3].

Two years later the Surveyor General was called on for a survey "of the shores of the Islands that run parallel to Saugor Island", and reported that Blane,

who has had more experience than any Other Person, ... says it well be impossible at this Season [April] to make anything like an accurate Survey of those Parts, on account of the heavy sea that runs there during the present Monsoon[4].

The survey was therefore postponed till October 1813[5], and on his way down Blane was commissioned to report on the river embankments near Diamond Harbour, which the Magistrate of the 24-Parganas considered

to have been constructed on a very erroneous principle, and that the great unhealthiness, which ordinarily prevails among the Shipping at Diamond Harbour, is in a great measure to be ascribed to that cause[6].

Blane submitted his map in April 1814[7], having had the assistance of Colvin, and reported that it

includes also the Survey of Saugor made in the summer of 1811. ... The Latitudes of its North and South extremities, which serve as a check to the whole, have been likewise determined. ...

A table exhibiting the area (in beghas) of the whole tract lately surveyed, and of Saugor Island, deduced from a careful calculation, has been added to the Map, on which also the observed Latitudes are recorded [177–8][8].

In the meantime Morrieson not only carried on his survey, but obtained an allotment of Rs. 3,000 to cut a channel

to join the Kallindi and Barrah Kooliah Rivers, ... 18 ft. deep & 50 ft. wide, ... and not half a mile ; and if opened would save two tides, or 12 hours ; at the same time do away with the Chota Koolia entirely, which is the most dangerous and difficult part of the whole navigation. ... The whole of the Salt manufactured in the Raymangal...will run much less risk in the passage[9].

In May 1813 he was joined by his brother Hugh, who had been on survey with Crawford [45]. The surveyors had to live and work in boats, which added greatly to expense and anxiety. In November, after

a very severe gale of wind, two of the boats furnished by Government were swamped ; ... were floated again after the storm, and sent...to be refitted. The boats after remaining 3 months in the Sunderbunds are fit for no other employment until they have undergone a repair[10].

The maintenance of the boats was a serious problem and Morrieson's reports

the difficulty there is in procuring boats and people to accompany me on the survey of the

[1] DDn. 126 (83), 8–4–11. [2] ib. (85), 8–4–11: 100 years later surveyors still required guards to protect against wild beasts, tho' the inhabitants were not so savage ! see narratives of Bengal Revenue Surveys 1912, and of Survey of India 1920. [3] MRIO. 51 (10). [4] DDn. 128 (135), 2–4–13. [5] BGO. 23–10–13. [6] DDn. 129 (85), 30–10–13. [7] MRIO. 3–PT–14; 9 furlongs to inch. [8] BMC. 30–4–14 (92–3). [9] ib. 11–4–12 (63–4); 20–2–13 (102). [10] ib. 6–11–13 (96).

Sunderbunds. In consequence of several attacks from Tigers, and in the course of the last three months, two men having been actually taken from the boats and killed, this difficulty has been much increased ; so much so indeed, that I am now detained in town by the difficulty experienced by the Commissariat Department in procuring people to go again there. ...

During the three years I have carried on the survey, it has been found absolutely necessary to change the boats every three months, as the destructive powers of the worms are so great. that the boats cannot remain longer than that time with any safety. The Boats now employed are liable to be swamped in strong winds, three boats having gone down since I have had the survey. ...

I would strongly recommend that boats should be built on purpose, and coppered, ... fitting them up at the same time to keep off an attack from Tigers, and capable of keeping the open rivers in blowing weather[1].

On 1st July 1814, William Morrieson was transferred, handing over charge to Hugh, who carried on till December[2] when survey was closed down on account of the Nepāl War ; by this time

William Morrieson...had completed that portion laying between the Hooghly on the West and the Jaboonah and Roymangal Rivers on the East. ... Hugh...had made considerable progress in the second portion (or from the Roymangal River Eastward to the Cubberdak), when his Services with his corps became necessary[3].

The surveys and fieldbooks of the two brothers are preserved at Calcutta[4], the fieldbooks being full of interesting details and adventures, such as ;

Just as the theodolite was rectified and we were about to take the first angle, a tiger made a great spring from somewhere into a bush about six yards from us, and there we lost sight of him. ...

Went on shore to take a latitude and, as the bank was very muddy, the dandies pulled the dingy up to the jungle, close to the only dry spot where we were observing the sun. Both of us were much annoyed by the trembling of the mercury, and abused the people around us for moving and shaking the ground, but they said they were perfectly quiet. Having finished the observations, one of the sepoys said there was a tiger close alongside that had been creeping up towards us, and for the last minute he and the animal had sat looking at each other. We now heard a slight noise in the jungle ; the two sepoys fired, and out sprang a tiger and ran off ; he was only about four yards from us, he on one side of a bush whilst we were on the other. Had the musket snapped, or the fire been delayed, he would have been amongst us[5].

CALCUTTA

On their return from surveying the mouth of the Meghna in 1803 [10], Knox and Nicholls were put "to survey the Balliagaut Road and the Skirts of Calcutta", till two Engineer officers, apparently James Robertson and James Hyde, took over the work in August[6]. The following year Robertson and Hyde were

appointed to prepare, under the orders of the General Committee for the improvement of the Town of Calcutta, and of the Special Committee appointed to consider the best means of draining the Town, an accurate Table of Levels for the Town of Calcutta[7] [I, 52–3].

In submitting their results Robertson asked for reimbursement of Rs. 1,600, "the payment of people whom I found it indispensably necessary to employ"[8].

In 1808 proposals were made by Nicholls, now head draughtsman at the Surveyor General's office, to publish a new map of Calcutta ;

The Survey will be carried on in a regular manner, to be done on a larger Scale than any hitherto published, to shew every person's Premises, and the Houses to be numbered, with the names of the Street or Lane in front, in Capital Roman or Italick Characters, in the same manner as the late elegant improved Plan of London ; to exhibit all the newly erected public or private Buildings from Chitpoor to Tolly's Canal, on the East & West side of the River Hooghly, with the Sand and Soundings in fathoms and feet at low water.

I humbly beg leave to notice to your Lordship that when that industrious individual the

[1] DDn. 147 (146), 2–5–14. [2] Joined by Schalch as assistant from 1st. October. [3] BMC. 24–5–16 ; (119) ; cf. report by J. E. Gastrell, 28–5–58. [4] MRIO. Misc. 2–0–14 ; 169 (14), etc. ; DLR. M. 281–5, 309 (a) ; cf. paper *The Gangetic Delta*, by W. S. Sherwill, *in Calcutta Review*, March 1859. [5] Sherwill. [6] DDn. 67 (247), 19–8–03. [7] BMC. 26–7–04 (58). [8] BPC. 26–5–05 (21).

late Mr. Upjohn published his Plan of Calcutta, Government were pleased to subscribe for Fifty Copies of the Work [I, 54][1].

Garstin recalled his experiences on the survey of the city 25 years before [I, 53], and advised Government

that such a work as the one proposed cannot be completed by any individual under six years hard labour, and that no publication, unless done at the expense of Government, will ever defray the necessary & unavoidable charge of executing it[2].

The scheme was not sanctioned, but was still cherished by McKay, who had also been one of Knox's assistants, and the following advertisement appeared six years later, though nothing is known of any map resulting ;

Proposals. New and extended map of Calcutta. 2 inches to 1000 feet ; by Mr. McKay, Marine & Land Surveyor, who has obtained permission to survey. To include the opposite side of the River Hooghly, bounded by the new Serampore Road ; all land inside the Mahratta Ditch, from South of Tolly's Nullah to a little North of Chitpore Bridge. Will show latest Improvements, and is the first map since Upjohn's of 1794. The work will be commenced as soon as a sufficient number of subscribers are obtained. ... It is hoped the map may be ready about commencement of 1816.

Subscriptions Rs. 100 each[3].

There was obviously good reason for a new map but no financial support. An official survey of the suburban area was, however, sanctioned at the request of the District Magistrate ;

In the research for the various old Water Courses of the suburbs, said to have been made for vents of the Town, the want of a map for my guidance...has been the cause of infinite difficulty and loss of time. This defect...has been a general encouragement to Individuals to encroach upon all the Water courses and Roads of the Suburbs in every direction, to the great injury of the Town and Suburbs. ... It becomes a subject of serious consideration to have a regular survey made[4].

Starting in April 1813, John Hyde completed the survey of Entally on the large scale of 90 feet to an inch[5], the Surveyor General reporting that the Magistrate requiring the suburbs of Calcutta upon so large a scale, and insisting upon such minutiæ in the measurements, renders this survey...extremely tedious, but when finished must prove very satisfactory[6].

After Hyde's transfer to charge of the Surveyor General's office Francis White was appointed

to collate and correct the Survey of the Suburbs of Calcutta that may be made by the Native Establishment which the Magistrate of the 24-Pergunnahs has been authorized to entertain[7].

White himself completed "A Sketch of the Roads in the Suburbs of Calcutta, from Garden Reach to Chitpoor", scale of 6 inches to a mile, outside Circular Road. Each of the original four sections of his survey forms a complete survey, independently orientated, the last being dated November 1815[8].

The survey of cantonments was a regular function of Engineer officers, and we have record of the survey of Dacca and Chittagong by George Steell[9] ; Barrackpore by James Robertson in 1804 ; and Dum Dum by C. J. Davidson in 1815.

Between 1812 and 1814 George Fleming, with the assistance of John Schalch, carried out an elaborate survey of the city of Murshidābād and Berhampore cantonments[10] "to enable the Committee of Embankments to effect improvements with success"[11]. He tells the Surveyor General that,

unless (amongst all your other duties in the Surveying line) you have been employ'd as I am (Surveying a dirty and populous Town with narrow streets), you can hardly form an Idea of the tediousness of the Work, from the innumerable Questions and Stops we are liable to, from the crowded streets, and from the immense number of Angles to be taken, which at times I am sorry to say [entail] the necessity of going over the day's Work more than once. Nevertheless I trust I shall be able ultimately to give in a satisfactory Plan of the Straggling City[12].

During 1811 and 1812, Blane surveyed the line for a new road from Calcutta to Diamond Harbour that the Postmaster General had asked for in 1808[13].

[1] DDn. 82 (44), 3–11–08. [2] ib. 81 (47), 25–11–08. [3] *CG.* 16–6–14. [4] DDn. 129 (1), 26–2–13. [5] Original MS. MRIO. 45 (27); printed copy, IRD. Lib. [6] DDn. 141, 23–3–14. [7] ib. (11), 30–4–14. [8] Originals sd. by White, MRIO. 45 (22–5); printed copies, IRD. Lib. [9] Progs. GG in C. 25–11–02. [10] MRIO. M 278–9. [11] BMC. 26–9–12 (123). [12] DDn. 130, 15–7–13. [13] BPC. 28–10–08 (52–3); BMC. 2–5–12 (89) etc.

DISTRICT SURVEYS, 1812–5

In 1812 the Surveyor General wrote that a

survey is also required for the Eastern frontier of Chittagong, as there is not the vestige of information concerning the greater part of it to be found in the Records of this Office, nor do I believe that, except for a small part of the Sea Coast [I, 59, 65–6], ... this extensive Frontier Province ever was explored, still less properly surveyed[1].

No officer could be spared till July 1814, when the Surveyor General was informed that

Ensign Harry Nisbet of the Engineer Corps has been directed...to Survey the whole of the cultivated Tracts of the District of Chittagong, which are not included in former Surveys, and to commence on this duty as soon as possible after the expiration of the present Rainy Season[2].

As Nisbet was transferred to civil the following month, John Cheape was appointed in his place, with William Garden as assistant, and directed to commence

the Work in those parts which may be indicated by the Collector...of Chittagong, with a view to the promotion of Public objects in the Revenue Department[3].

Garden was called off for field service against Nepāl, but Cheape, the only surveyor allowed to continue work through the war, completed the survey by 1817.

Early in 1814 James Jackson was deputed to survey about 600 square miles south and south-east of Bishnupur[4] to facilitate adjustments in the boundaries of the Jungle Mehāls (now Bānkura), Burdwān, Hooghly, and Midnapore districts, and also to lay out the line for a new road[5]. The following extracts are taken from his letters to the Surveyor General;

I shall most readily attend to your wishes, particularly as I am but a young surveyor, and many things may not strike me, which in the eye of a more experienced person are absolutely requisite. ...

From Bishenpoor it is my intention to proceed towards Gurh Simlapol, & as the route I shall take is but little known, I shall not hurry over it, but try to visit every village in the Jungle, for the whole route, I understand, is nothing but a woody Jungle[6]. Since I left Bishenpoor I have been through nothing but thick wood Jungle, & parts of it composed of very fine saul trees.

From Gurh Simlapol I have followed the course of the Selu River, marching in its bed. I have adopted that method with a view of convtly. ascertaining the windings of the river; I trust this plan will be approved of by you; I followed it from the idea of its being the only method by which I could well get the true direction of the river, for it is impossible to travel along its banks owing to the thickness of the Jungle[7].

Jackson was called away to military service in January 1815, but resumed the survey after the war[8].

In Bihār we have only two surveys of interest to note. During 1811–2 James Peckett surveyed a line for a road between Patna and Gaya[9], and in 1815 William Francklin, a student of historical geography, surveyed a large part of the Santāl Parganas in order to locate the course of the Chandun River, reputed to have been the Erannoboas of Greek historians[10].

GANGES–HOOGHLY PASSAGE, 1801–12

In 1801, in spite of the discouragement which he had met five years earlier [I, 64], Colebrooke re-opened the question of a passage from the Ganges to the Hooghly,

having frequently reflected on the possibility of improving the Inland Navigation of Bengal, by keeping open during the dry season the Cossimbazar or Jellinghy River[11]. ...

[1] DDn. 128 (114), 8–9–12; but see first sentence of SG's. letter of 5–3–04 [13–4]; meanwhile Sheet 9 of Rennell's 5-inch Provincial maps was lying forgotten at India House [I, 225]. [2] DDn. 141 (53), 15–7–14. [3] ib. (79), 11–11–14. [4] 73 M/8. [5] Instructions, DDn. 130 (155), may be followed in detail on *Ben. Atlas*, vii. [6] DDn. 130 (153), 24–2–14. [7] ib. (169), 9–3–14. [8] Map about 1″ to a mile, MRIO. 40 (20). [9] DDn. 126 (102), 9–8–11; and 128 (110), 23–3–12. [10] DDn. 141 (69), 21–10–14; maps, MRIO. 164 (10). [11] Break from Ganges 78 D/2 and D/12 respectively.

The Machine I would use, two models of which I have the honour to transmit, should be about the size of a Gun Carriage, with very broad wheels or Tracks, the latter of which might be armed with spikes. A large rake with Iron Claws might be suspended over the Axle-tree, with a long Lever in front, by which it could at any time be extricated from the sand. These Machines would require several yoke of Oxen to drag them, instead of Horses which are used in Europe. ...

I would propose that an adequate number of Bildars[1] and Coolies be employed to excavate a part of the channel to a depth of two feet, ... after which there might be reason to hope that with the help of the dragging Machines, the current of the River would deepen it still more. ...

The whole process of the experiment would probably last but a few days, and I should hope that if it were successful there would be no occasion for a repetition of it during the remainder of the dry season. ...

I could not pretend to form an estimate of the total expense of the scheme previous to surveying the Jellinghy and Culculia, taking the necessary levels, and sounding these Rivers throughout[2].

In August 1802 he submitted an estimate of Rs. 10,000 for carrying out the work[3], but money was not forthcoming, and in 1804 he wrote to Robertson who was returning from survey of the salt agencies [14] ;

You could on the first rise of the rivers return by the Jellinghy, ... and you could also examine the Inlet of that River, with a view to clearing and rendering it navigable in the dry Season, a project which you know I have long had in view, but which it is not probable I shall ever have time to execute, as the labours of my Office are daily increasing. ...

The usual entrance to the Jellinghy for some years past has been through the Culculia[4] I believe, but the old Inlet was reported a year ago to have opened again. It would be well worth while to explore both passages just at the commencement of the rains, and you could be in Calcutta by the middle or end of June[5].

Five years later Garstin took up the attack again ;

In reply to your letter...directing me to recommenda Proper Person to survey the Issamutty River[6] and Hurdum Nullah[7], ... we have not a single officer in the Engineer Department, who is qualified for this task, that can be spared [310]. ...

I therefore propose...as the River will now soon be at its greatest Height, to proceed up the Nullah, and direct Pointed Pins to be driven at proper distances to ascertain the exact rise of the Water at the next Spring Tides, ... and the level will be correctly ascertained. The expence of the Work will be very inconsiderable ; my Boat Allowance for the time I am absent [324], and certainly not more than one Hundred Rupees for contingencies. ...

A Guard of Sepoys is requisite, as that part of the River is infested with Dacoits, who will view any Person employed to measure the Nullah with great jealousy[8].

Garstin made his survey during March 1810, measuring a distance of 265 miles up the Churni into the Ichamati[9] ; and also

paid Deen Mahomed, Native Surveyor, sent to investigate the course of various channels that fall into the Issmutty and, if possible, to discover a practicable communication with the Ganges ; his expenses, Rs. 72–8–0[10].

Reviewing a proposal to cut a channel above Murshidābād, Garstin gave a history of earlier schemes, and pointed out grave reasons against success ;

In the year 1780, when Major McGowan attempted to open this river [I, 63, 356], I went up and carefully examined the Baugrutty, from Sooty, upwards to the bank of the Ganges near Furruckabad[11], and downwards...to the Mouth of the Jellinghy ; this Tract is now totally changed, and has within this period been altered many times. ... The Ganges now runs within Five Miles of Moorshedabad. The old bed can be easily traced. This River will never remain at rest. ...

Is Government prepared to run the risk of having the Course of the Ganges turned into the Baugrettey, and half of the City of Moorshedabad swept away ? This is possible if the Cut is made, tho' by no means a probable event. ... The labours of my Predecessors, Major Rennell and Lt Col. Colebrooke, shew the extraordinary and constant change the Ganges has made. ... It would be a little rash to venture on such an experiment before the present state of the Ganges has been accurately surveyed, and its effects on the Banks carefully noted during the highest

[1] Professional diggers. [2] DDn. 67 (43–7), 12–5–01. [3] ib. (119), 17–8–02. [4] Culcully R. ; *Ben. Atlas*, vi. [5] DDn. 67 (301), 5–3–04. [6] Breaks from the Ganges 78 D/16. [7] Also called Churni N. [I, 63 ; II, 21]. [8] DDn. 81 (132), 27–7–09. [9] Map, MRIO. 163 (1). DDn. 126 (24), May 1810. [10] ib. (91), 19–3–11. [11] 78 D/2 to P/13 ; *Ben. Atlas*, ii.

Floods. ... It is a weighty and momentous concern, upon which may depend the welfare of Thousands, and not, as it appears in the Papers submitted to my report, a trifling consideration of a few Rupees[1].

The survey was made by George Wilton in September, and Garstin, after making a personal examination of the various channels affected, modified his original opinion and recommended that the proposed cut might be made with every prospect of success ;

As it is certain that for some Years past the Ganges has been seeking a new Passage lower down, and has actually opened one through the Howleah...at Sibnibas[2], into the Choornie and Hoogley, ... it is possible that the Cossimbazar River may be left dry, or nearly so ; which serious mischief will probably be prevented by the proposed Cut[3].

The work was duly sanctioned, and eighteen months later was inspected by the Governor General, Lord Moira ;

July 15th [1814]. Reached the cut between the Baughretty and the Ganges, near Sooty, early in the afternoon, but as the current was so strong...I walked to the cut to examine it. ... The obstruction to navigation experienced for some months every year, on account of the shoals at the natural junction of the Baughretty with the Ganges, induced our Government to try whether, making a canal...across a narrow sandy strip, a permanent communication might not be effected. The cut was accordingly undertaken. As soon as the water of the river was led into it the force of the stream achieved what was far beyond expectation. It has ploughed a channel of considerable depth, about one hundred and fifty yards in breadth ; and the flow of water through is such as gives reason to believe that the junction is secure for every season[4].

Garstin himself went through shortly after, and reports that he found it

so clear and spacious a stream, that to the best of my Judgement and belief there is no chance of its being again closed for many years, which will be of inestimable advantage to the general Commerce of the Country, and particularly to the City of Moorshedabad[5].

The temporary success of this experiment does not, however, prove that Rennell was wrong in advising great caution before tampering with the natural flow of great rivers [I, 64].

There is an interesting *Report on the Rivers of Bengal*[6] by W. S. Sherwill, Revenue Surveyor, on the investigations of a committee which sat in 1853 regarding the deterioration of the Hooghly. It is shown that at one time the whole waters of the Ganges had passed down the Bhāgīrathi into the Hooghly and so to the sea. Before the advent of the English, the Hooghly was named Bhāgīrathi from Suti to the sea, though the name now only applies to that part above the junction with the Jalangi at Nadia, which is also known as the Cossimbāzār River ; the portion below this junction having acquired the name Hooghly comparatively recently from the once important town of that name.

Sherwill supports Wilford's historical conclusions [I, 63] that Rājmahāl once stood on the shores of the ocean and that Nadia was once an island. He concludes that the Bhāgīrathi in its present state could never be relied upon to flush the Hooghly, which in 1857 was shallower than it had been 100 years before.

THE GANGES HIGHWAY, 1801–7

We have already recorded many of Colebrooke's journeys up and down the Ganges, and his great interest in its changing channels [I, 64–5]. He had another opportunity of surveying the great highway when he accompanied Lord Wellesley on his visit to Oudh in 1801[7] [26] ;

During my late excursion to the Upper Province while in attendance upon His Excellency the Most Noble the Governor General, I had an opportunity of making some useful observations on the state of the Ganges during the high Floods, and as soon as the river had subsided within its banks I carried on a cursory Survey of it from near Colgong[8] to Patna. ... Availing myself

[1] DDn. 128 (64–7), 4–5–12. [2] 79 A/11. [3] DDn. 128. (117–22), 14–12–12. [4] Hasting's *Journal* (48). [5] BMC. 19–11–14 (192). [6] *Ben. Sel.* X. 19–2–57. [7] GG. left Calcutta 15th. Aug.; arrd. Patna 6th Oct.; Lucknow 3rd. Feb.; Patna, 23rd. March 1802. [8] 72 O/7.

of the permission which His Excellency was pleased to give me to quit the Fleet for that purpose, I surveyed the River Ganges from Patna to Allahabad throughout 300 miles of its course[1].

This survey, as it connects with Captain Wood's at Allahabad[2] will...furnish a new set of Charts of the Ganges from Hardwar to Patna, throughout more than 800 miles of its course, and, should an opportunity be afforded me of completing the Survey of that River as far as Patna, and connecting that with the Survey I took in 1796 from Colgong to Hurrisonker [I, 64], the Government would soon be in possession of an entirely new and connected survey of the Ganges throughout more than eleven hundred miles, which I could, in one or more excursions of about four months, not only complete as above stated, but also continue to its confluence with the Megna. ...

These Surveys are laid down on a scale of one Inch to a Statute Mile, which is five times larger than the Charts published in Major Rennell's Atlas [I, 229][3]. ... Since the former Surveys from which those charts are taken were made, the River has undergone very considerable alterations in many parts by the encroachment of the stream on its banks, and the forming of Islands and Sands ; also by the entire desertion of its bed in some places. ...

These Surveys of the Ganges are more particular and, I trust, correct, than any which have hitherto been taken ; ... in many parts they include a number of Towns and Villages which are situated at a considerable distance from its banks, many of which had not ever been inserted in our maps, and...in showing all or most of the Ferries, and in the Upper parts of the country the Fords, as well as in giving a truer orthography to the names of places, they are superior[4].

In 1821, the Legal Remembrancer asked for a copy of this survey ;

An appeal is now depending...in which the Collector of Shahabad, on the part of Government, claims a large tract of Diarah land, which, by the river changing its course, has become annexed to Shahabad ; and my object in wishing to see Colonel Colebrooke's survey is to ascertain the exact course of the main stream at that time[5].

Robertson was not able to survey the lower Ganges as Colebrooks suggested ;

If you could possibly keep to your Boats during the Hot Months, much might be done before the rains towards completing the Work, and you could survey the Ganges from its junction with the Megna, up to where my Survey of it terminated in 1797, viz. at Hurrisonker, a few miles below the Head of the Jellinghy. This is not so immediately connected with the Survey of the Salt Agencies as the rest [14], but would nevertheless be highly beneficial to Geography, as no Survey of that part of the Ganges has been taken these 40 years[6].

In 1805 Colebrooke asked that he might go out again himself ;

It remains only now to continue the Survey between Patna and Colgong in order to complete a new and correct set of Charts of the Ganges from the Head of the Jellinghy to Hardwar. ...

The Ganges in its progress through Bahar and Bengal has within these 30 years very materially altered its Course, and...the Charts of that River which have been published in Major Rennell's Bengal Atlas have been in consequence rendered almost useless. ...

A survey of the Dewah, or Ghoggra, River is likewise very desirable, both with a view to obtain a more correct Chart of that river, which is at all times navigable, and to complete the Surveys of Oude and the Ceded Provinces [26 n.1] through which it flows. ...

I now beg leave to request that His Excellency would be pleased to depute me on the Surveys above proposed, the whole of which...could be performed between the 1st of June and the latter end of November ensuing, and I could in returning survey the Jellinghy with a view to ascertain how that River is likely ever to be rendered navigable in the dry Season[7].

It was not until 1807 that he could get up country on this survey. He left Calcutta by boat travelling by way of the Sundarbans and Dacca [29],

with a view partly to Survey a New Channel which...had opened itself between the Ganges and the Brahmapootra Rivers, as well as to make such other observations on the state of the Rivers to the Eastward as the proposed deviation from the usual track from the Sundarbans might enable me to perform[8].

He writes from Dacca ;

I have found very considerable deviations from Major Rennell's Maps, and in some no resemblance whatever could be traced, owing chiefly, I apprehend, to the alterations which in a series of years have taken place in the beds of these Rivers, in a loose and Sandy soil. In some parts whole villages...have been either swept away, or removed by the inhabitants to the opposite side of the stream, or to some safer spots where the River was not so likely to encroach on its banks. ... I am persuaded that Major Rennell's Maps of this part of the Country,

[1] Original maps MRIO. 164 (11 *et seq.*) ; 165 (4–8) ; 167 (11–2) ; 168 (7–9) ; Fdbks. DLR. M. 467, 475. [2] Surveyed by Wood, March-April 1802 [26]. [3] *Ben. Atlas*, plates xiv to xvii. [4] DDn. 67 (82), 4-3-02. [5] ib. 191 (97), 15-3-21. [6] ib. 67 (301), 5-3-04. [7] ib. (369), 9-4-05. [8] BMC. 2-4-07 (106).

or any others which are in the Surveyor General's Office, can be of little or no use to the Magistrates and Collectors, or for Military purposes.

I purpose resting a few Days at this place, after which I shall pursue my voyage to the westward by a different route to that which I came from the Ganges, continuing my observations as I go, in order to render this Survey as extensive and useful towards correcting some of the inaccuracies of the Maps as possible[1].

Again from Patna in July ;

Having surveyed the Ganges between Hajygunge and Hurrysonker[2], I came to that part of the river which I had surveyed with so much pains and minuteness ten years ago, but I was sorry to find that from thence to Colgong, where my former Survey terminated, little resemblance could be traced between the River and my Charts the whole way ; many villages and considerable tracts of land having been swept away, while other Lands or Islands which had been thrown up by alluvion, though mostly in a wild and hitherto uncultivated state, appeared in other parts which had formerly been occupied by the stream.

I hope to be able to leave this place, or Dinapoor, by the 7th, and to commence the Survey of the Goggra River, which is more immediately connected with the object of my deputation, by the 10th of this month[3].

Copies of these river surveys were supplied as a matter of course to the Governor General and the Commander-in-Chief whenever these great men travelled up country[4], and a complete set, specially prepared by Garstin for Sir George Nugent's trip in 1812[5], is still preserved. There is also a beautifully drawn map of the Ganges between the mouths of the Gumti and Gogra, surveyed by Stephen in 1812 [36, pl. 18][6].

ORISSA, 1803–13

Though the *dewāni* of Orissa was granted to the Company by the exiled Emperor of Delhi in 1765, the only portion of the province then occupied was Midnapore, which had become part of Bengal so early as 1706, whereas the remainder of Orissa had been granted to the Marātha Rāja of Nāgpur (or Rāja of Berār) in 1751 [I, 24 n.8][7].

When, in 1803, the Company became involved in a general war against the confederated Marātha powers [57], a Madras force under Lt. Colonel Harcourt captured Puri and Cuttack[8] and, under a separate peace concluded with Nāgpur in December, the whole of Orissa passed to the Company.

James Blunt was attached to Harcourt's force as Engineer and Surveyor, remaining in the province till 1805. He made route surveys from Balasore to Ganjam, a detailed survey of the neighbourhood of Cuttack, and compiled a general map[9] from his own work and from surveys by Charles Collins[10], Knox, and McCarthy [5, 11–12].

At various times, Sealy [44], Patrickson, and others[11], surveyed routes from Cuttack to Sambalpur, and in 1808 the Surveyor General proposed a survey of the teak forests along the Mahānadi ;

From the conversation I had with Rear Admiral Drury[12] on the subject of Timber in the Forests, I am induced to represent the great benefit that would arise...from sending a Surveyor into the Teak Forests on the Banks of the Mohanuddy and Taillee Rivers in Cuttack, as from the Report of Captain Sealy...large quantities may be drawn from those Woods[13].

As a detailed survey of the province was desirable for other purposes also, Sackville was transferred from Bundelkhand at the end of 1809, and, with Blane as assistant, given the following instructions by the Surveyor General ;

To save time and...the expence of again surveying any part...that has been already laid down, I have furnished you with Copies of all the Papers in the Office. ...

This Province being very low towards the Sea, and the Morasses at the Foot of the Hills unwholesome, I would recommend your first verifying the Survey of the Center part from

[1] DDn. 81 (75), 13–5–07. [2] 79 E/4 to 78 D/16 ; see *Ben. Atlas*, i. [3] DDn. 81 (81), 3–7–07. [4] ib. (29), 4–8–07. [5] MRIO. 163 (16–8) ; 165 (104 *et seq*) ; Account of trip, Nugent. [6] ib. 168 (32–3). [7] Wills (27 n). [8] 18/9 and 13/10, 1803. [9] Fdbks., Blunt, MRIO. M. 267, M. 271. [10] Maps, BM Addl MSS. 13903 (b, c, d) ; MRIO. 55 (43–9) ; 63 (27) ; Misc. 4–0–03. [11] Fdbk. Patrickson, 1806, MRIO. M. 334. Sketch, anon., MRIO. 161 (1). [12] V. Adm. Wm. O'Brien Drury, C-in-C. EI. Squadron at death in March 1811. [13] BMC. 28–11–08 (69).

Balasore, thro' Cuttack, to our Southern Boundary ; which will serve as a Base Line for the construction of the whole Survey. You will carefully observe the rise and fall of the Land, so as to be able to point out the most advantageous Line of direction for a Public Road [25]. ...

You will be pleased accurately to note the Breadth and depth of every Stream you cross ; to mention the Places where small Bridges can be conveniently built ; the Number of the Country Boats that will be required to make a passage over the large ones, and to find out whether they are procurable or not ; you must mark in your Survey the general width the Rivers attain in the Rains, and...to shew what parts of the Country are usually overflowed. ...

By the time you have carefully surveyed this tract of Country, the Sea Coast will have become healthy, and will continue so until the end of April. This Season should be taken to investigate it, to lay down all Creeks and Inlets from the Sea ; also to point out the Places where a landing can be effected ; enquiry should be made respecting the Boats used by the natives for landing from Sea ; ... pains ought to be taken to obtain information concerning the Population and Produce of the Country. ... The seasons that are considered as the most sickly ought to be noticed, as well as the cause of its being unhealthy, if it can be discovered.

Your Survey along shore should be extended as far as Kedgeree, there being no correct Map of that part of the Coast, which may hereafter become very important.

As you pass Point Palmyras, you will carefully examine it, and the small Island at its Base, and state your opinion...which is the best place for the erection of a Light House [11]. ... The entrances into the Kannaka, Keddra, and other Rivers ought to be laid down on a large Scale, as well as those of the Balasore and Pipley [or Subarnarekha] Rivers [11]. ...

In May the Hilly Country becomes accessible ; it will then be advisable to pass round the bottom of the Hills with a view to lay down the Ranges correctly, and to determine on the practicability of carrying on a Military Road at such a Height at the Foot of them as to avoid the innundations during the Rainy Season, and to transport if possible Heavy Artillery ; to this end the passages of the Rivers...will require accurate observation, and the mode the Natives use in crossing them be fully explained. You may probably remember my showing you a Survey of a part of the River Mohanuddy by Captain Sealy, which particularly described its bed, and shewed the Rocks in it. This appeared to me an excellent example and well worthy of imitation, and it will be proper to point out the Height to which these Rivers are Navigable, ... and to state during what Months they continue to be so.

When you approach the Forests it will be advisable to make particular enquiries concerning the Species of Timber they contain, and the possibility there is of removing it during the Rains. Teak certainly grows on the banks of the Mohanuddy, or of some of the Streams that flow into it. This being the most valuable of all Indian Timber, as soon as you discover it in any Quantity, it should be reported [167–8]. ...

All the Passes into the Country must be correctly laid down on a large Scale, and the fullest information as to the practicability of conveying Heavy Artillery and marching an army through them ; ... all these circumstances should be detailed in your Field Book, ... for it is not only a Map of the Country that is required, but it is fit Government should have the fullest and most correct intelligence concerning it[1] [5–6].

Sackville found Blane a useful assistant, and reported ;

I have every reason to hope that by the Time we have completed our return to the vicinity of Calcutta, Mr. Blane's progress will be such as to render his continuance with me no longer necessary. In the meantime I have desired him to furnish me with a clean copy of our route from Calcutta to Ganjam[2], ... which will no doubt be valuable appendage to the report, and will afford at the same time a specimen of Mr. Blane's skill. ...

We are now making the Tour of the Western Frontier of the District, ... and on the 3rd of March we expect to reach...the right bank of the Mahanuddy. The country we have passed through since we quitted Ganjam has exhibited little else but Jungle, ... which we have every reason to suppose will continue to prevail in our Travels to trace the Northern Frontier.

We have already observed that these forests abound with Teak ; the general dimensions of the Trees we have already seen have been very large. ... The season I am happy to say is very favourable for our present trip through this barbarous Tract, and everything conspires to render it as pleasant as possible[3].

And three months later,

Ensign Blane and myself were employed Surveying the Mahanuddy and other Rivers from

[1] DDn. 81 (167–71), 14–12–09. [2] MRIO. 47 (8–13). [3] DDn. 82 (138), 1–3–10.

the 27th of March inclusive to the 1st June, ... and a Plan of these Rivers is now preparing and will be forwarded to you as soon as possible[1]. ...

Agreably to the Regulations, I have availed myself of the Indulgence granted to Surveyors of returning to cantonments on the 16th June, the official commencement of the Rainy Season. Ensign Blane...left me on the 1st of June, and I hope by this time has arrived safe at the Presidency ; I have already reported to you the assistance which I have derived from the Talents and assiduty which that officer uniformly displayed[2].

Other young officers, Stephen and Peckett, were sent out "to learn the art of surveying" and in September 1812 the Surveyor General reported

that the survey of the Province of Cuttack in Orissa is now completed by Captain F. Sackville, who has delivered to me his general map, laid down on a scale of two miles to one inch[3]. ...

I understand that it is the intention of Government to employ Captain Sackville in the construction of the Road to Jaggernaut[4], an important occupation that will...leave no leisure for surveying. Tho' this Officer has been very diligent, and done a great deal towards the completion of the Map of the Province of Cuttack, Yet there is still a full year's employment for a Surveyor on the Western and North Western boundaries of it ; they are only sketched in by Captain S. and pass thro' Countries which, from being nearly Deserts under the oppressions of the Mahratta Government, are now making rapid strides towards improvement, and their population visibly increasing. In these parts there are many Passes of importance leading into Berrar and Goundwannah [45, 134][5], that in a Military point of view ought to be carefully surveyed and laid down. I therefore request...that this Survey may be completed and not, as formerly frequently has happened, be left unfinished[6].

The Nepāl War prevented the Surveyor General's advice being followed, and the only available surveyor, Henry Sandys, who was deputed in May 1813 "to survey the Embankments"[7], was recalled to military duty in January 1815.

[1] MRIO. 161 (2). [2] MRIO. (188, 204), 16–6–10. [3] ib. 55 (32 *et seq*) ; Maps include Angul and Eastern Orissa States. [4] or Puri, 74 E/13. [5] Gondwāna, nominally the country of the Khōnds, " corresponds fairly with the Satpura Plateau" ; *Imp Gaz. C I.* 55 ; M, N ; 64 A, B. [6] DDn. 128 (114), 8–9–12. [7] ib. 130 (17), 3–5–13.

CHAPTER III

UPPER PROVINCES & OUDH

Frontiers of Oudh, 1802–3 — Route Surveys, 1803–10 — Colebrooke's Survey, 1807–8 — Oudh & Gorakhpur, 1808–14 — Ganges–Jumna Doāb, *1811–4 — Nepāl War, 1814–6.*

ON 10th November 1801 a treaty was signed with the Wazīr of Oudh under which he ceded Gorakhpur, the lower *Doāb*, and Rohilkhand[1], in return for the Company's protection against the Marāthas [5, 27, pl. 1]. On Lord Wellesley's visit to Oudh shortly after [21–2], Thomas Wood was detailed to survey the new boundaries, and the Surveyor General acknowledged

letters...acquainting me that you had been ordered by His Excellency the Most Noble the Governor General to commence immediately a Survey of the Western Boundary of the Nabob of Oude's Territory. ... Likewise that you had completed the Survey of the River Ganges from Allahabad to Caunpoor [22]. ...

From whatever spot the Boundary between the Ceded Districts and the Nabob's Territory may commence at the Ganges near Fattehghur[2], you will be pleased to follow its direction, and survey it up to the Hills, or as near to the Hills as it may be practicable to penetrate[3].

As in doing this you will cross the Route which you surveyed...to Pileebeat[4] in the year 1800, you will be able to connect your present with your former Survey [I, 58; II, pl. 5], and should an opportunity offer of visiting the spot where the Sarjou or Goggra River descends in cascades from the Mountains, I would recommend to you by all means to do so.

The place, which in Major Rennell's Map of Hindoostan is called the Cataract of Kanar [I, pl. 6] is laid down by him under the parallel of 29°, and about 40 miles North of the Town of Bartapoor. In the old General Map it appears to be nearly in the same Latitude, but as in tracing the Boundary towards the Hills you will probably draw much nearer to it..., it would be well worth your while, and of great use to Geography, to visit and fix the position of that curious spot[5] [353]. ...

After you have surveyed the Boundary and visited, if practicable, the Falls of the Goggra you will be pleased to return to your station at Caunpoor by the way of Pileebeat, Shahjihanpoor, Mohomdy..., carefully noting and observing everything that can be useful or interesting in a Geographical and Military survey.

As the total Distance in this Survey will scarcely exceed 300 Miles, I trust you will be able to complete it before the ensuing Rainy Season[6].

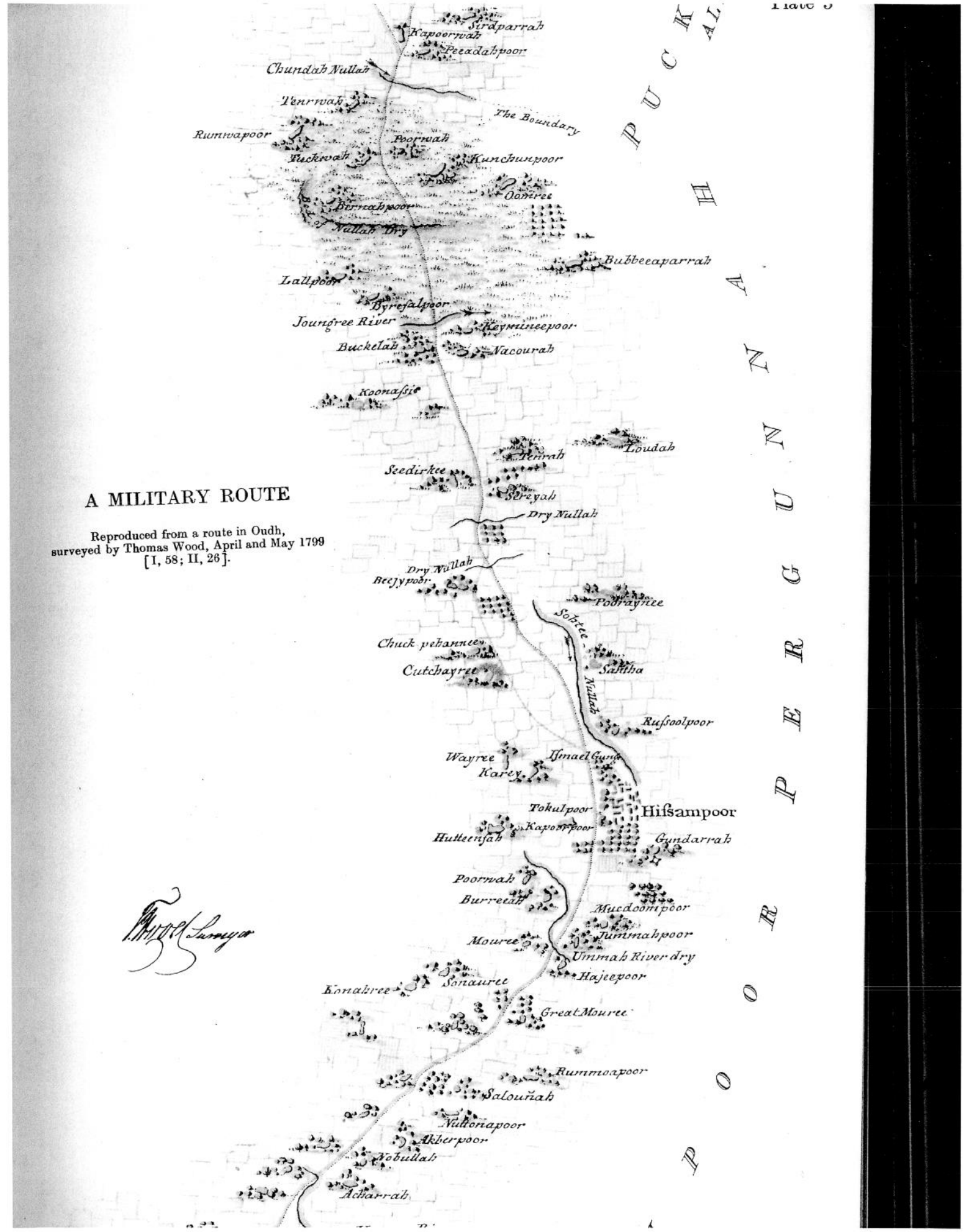
Colebrooke reported at the same time that Wood had

completed the Survey of the River Ganges[7] from Allahabad to Cawnpore which now forms the South Western Boundary of the Nawab of Oude's Territory. This...connects with his Survey of the Ganges from Hurdwar to Cawnpore [I, 58], and which now throughout a considerable part of its course is become the Boundary betwixt the Countries lately ceded to the Hon'ble Company and the Mahrattas[8].

In September he reported that Wood,

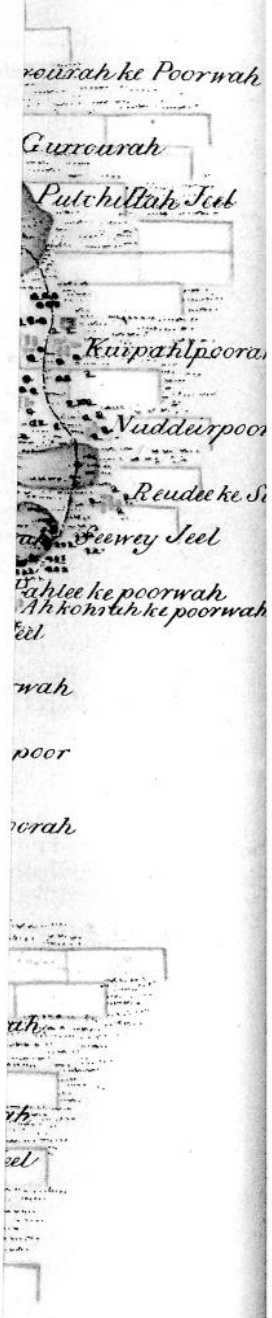
now at Caunpoor, who was lately deputed on the Survey of the Nabob of Oude's Western Boundary[9], ...had...finished the protraction of that part of his Surveys but, having on his return by way of...Baraitch and Fyzabad to Lucknow continued his Survey through a part of the Country little frequented, and which would require time to lay down and finish[10], he requested on that account, but chiefly on the plea of his Health having been injured by his late Surveys, to be relieved from any further duty of that sort [I, 399–400].

[1] Known hereafter as the Ceded Districts, or Provinces. [2] 54 M/11. [3] Wood included svy. of E. & S. limits Khairīgarh (62 D/15); DDn. 668 (204), 21–9–59; *v. Imp Gaz. XV* (270). [4] Pilibhīt, 53 P/14. [5] Visited later by Colebrooke himself [31–2]; Wood did not succeed in getting so far. [6] DDn. 67 (72), 10–2–02. [7] Ganges from Usni upward to Cawnpore, Jan. 1802; 1″ to 1m. ; MRIO. 167 (5, 8). [8] BMC. 6–5–02 (44). [9] Surveys, March, April, 1802; MRIO. 29 (41), 30 (5, 22). [10] Wood's Survey of E. frontier of Oudh, MRIO. Misc. 5–0–02, referred to by Colebrooke later [30].



A MILITARY ROUTE

Reproduced from a route in Oudh, surveyed by Thomas Wood, April and May 1799 [I, 58; II, 26].


Gurrourah
Pulchillah Jeel
Kurpahlpoora
Vuddeerpoor
Reudee ke S
Seewey Jeel
Pahlee ke poorwah
Ahkomlah ke poorwah

I take the liberty, in consequence, of proposing that...Ensign Smyth, of the Engineers, now at Allahabad, who acted as his Assistant during his last excursion, might be directed to commence the Survey of the Eastern Boundary of the Nabob's Territory. ...

Survey of the Caunpoor District, required for the use of...the Collector, might at the same time be commenced by Ensign MacDougal of the Engineers, who is stationed at Caunpoor[1] [199 n.3].

Smyth surveyed the eastern boundary of Oudh between November 1802 and June 1803, fixing many places "mentioned in the treaty with the Nawab, but... never inserted in any of our maps"[2] [pl. 6]. He was told that, north of the Gogra, the limits of the Ceded Districts are extremely uncertain ; it will be necessary that you should procure new guides to show you the whole of the remaining Boundaries as far as the Hills... and...to endeavour to penetrate to, or at least to ascertain the position of, Butool[3], whose Rajah is now tributary to the Hon'ble Company[4].

Before he could finish off his maps[5], he was called away to join Lake's army, now moving against the Marāthas [57].

MacDougal's was told

to furnish the Collector of Caunpoor with an accurate map of his District, and to complete the Geography of a considerable portion of the Dooab. ... You should request Mr. Welland to give you a list of all the principal Towns and Pergunnahs within the circuit of his Collectorship, and to send guides with you to shew the several Boundaries[6].

He was to make one of his stations at "the Magazine Ghaut, where Mr. Reuben Burrow observed the Latitude" [I, 160], but, after less than three months work was called away to Calcutta [269].

ROUTE SURVEYS, 1803–10

The treaty with Oudh in 1801 provided for the establishment of several military stations scattered over Oudh and the ceded districts [26] and, with the Marātha War of 1803–6, gave many opportunities for the survey of military routes [1, 5], of which the following may be noted.

William Wilson's "march of the flank companies of H. M.'s 22nd Regt. from Fort William to the Grand Army" at the end of 1803 was "very useful"[7].

Nathaniel Grant, who surveyed the route of his battalion from Muttra to Benares in February 1806, and from Secrole to Barrackpore in 1808[8], was afterwards one of Malcolm's explorers in Persia [174–5].

During 1805 and 1806 William Webb surveyed routes from Muttra to the Siwaliks that were "drawn with considerable neatness" and were "excellent models"[9] [pl. 7].

Henry White surveyed the routes of his unit during 1808 "during the period that Corps was on Escort Duty with His Excellency the Nawab Vizier"[10], whilst Nathaniel Bucke kept a survey of the "Route of the 2nd Batn. 16th Regt. thro' the District of Baraitch...January 21st to May 20th 1808", and again "thro' part of the reserved Territory of the Nawab Vizier, in pursuit of the Imposter Vizier Ally, ... July 22nd to August 1st"[11].

A valuable survey of a different character was run by Charles Crawford during the cold weather 1804–5 from Purnea to Hardwār, a zigzag line that took 4½ months to survey[12] [35]. This was originally suggested by Crawford as complementary to his surveys of Nepāl, in order to survey the northern frontier of Bengal, the course of the great rivers issuing from the mountains, and the positions of the snowy peaks [71, 85–6]. Colebrooke had also suggested his tracing the Ganges to its source, but by the time Crawford reached Rohilkhand, further survey was prevented by a Marātha invasion.

[1] DDn. 67 (126), 18–9–02. [2] SG's. letter 9–10–02 ; B S & Pol. 21–10–02 (111). [3] Butwāl, 63 M/6 [39]. [4] B S & Pol. 21–10–02 (10–1). [5] MRIO. 18 (1–3) ; 30 (20. 33–4) ; Misc. 26–0–02 ; 2–0–03 [pl. 6]. [6] B S & Pol. 21–10–02. [7] DDn. 67 (314), 18–4–04. [8] Fdbk. MRIO. 543 ; DDn. 81 (3, 4). [9] Fdbk. MRIO. M 543 ; map, ib. 13 (19) ; DDn. 67 (427, 474, 477) March to June 1806 ; 81 (71), March 1807. [10] DDn. 126 (111), 23–10–11 ; 128 (111) Fdbk. DDn. 162. [11] DDn. 81 (23) ; 82 (31) 2–9–08. [12] Maps, MRIO. 30 (32, 91–9).

After resuming command of his battalion, Crawford made a practice of surveying the various cantonments at which he was stationed. He spent "ten months in laying down the City of Benares, including the Town of Ramnagar", and describes a "trigonometrical survey" of Etāwah[1] which

embraces an extent of Country of about eight miles by six. ... My reason for this extent was that it might take in, besides the Cantonments, the City & New Town of Etawah, the Old Fort on the banks of the River, two Gauts above the City Gauts, & as many below. As it is a Frontier Station I conceived a knowledge of the different roads that lead to the Maharatee States would be acceptable. ...

But what constitutes the strength of the Post are the numberless Ravines on both sides of the Jumna, as well as on the Chumbul, whose depths [increase from] 2 or 3 feet at their commencement to 80 or 90 as they approach the River ; this was the most laborious and dry part of the Survey, as from their nature neither Horse or Elephant could be made use of ; I was therefore forced to do the whole on foot.

In the Cantonments I have laid down all the Bungalows with their several Gardens & Wells, & have accurately marked the boundary line as laid down by the first Commandg. Officer...& the Collector[2].

Orders had recently been issued for the survey of all cantonments [34, 61]; in January 1810 Peter Lawtie, of the Engineers, started a survey of the cantonments at Cawnpore[3], and during 1811 Parlby, of the Horse Artillery, surveyed Meerut cantonments[4].

COLEBROOKE'S SURVEY, 1807–8

As the affairs of Oudh were attracting much attention in 1801, and a large proportion of the Bengal army was stationed in that country [26], it is not surprising to find the Surveyor General writing to the Commander-in-Chief ;

It appears on an inspection of the best Maps we have of the Provinces of Oude and Rohilcund, and the country included between the Rivers Ganges and Jumna (called Dooab), that much remains to be done towards perfecting the Geography of these Countries.

The Surveys procured, within these few years, of several routes through the Nabob's territory, of the Jumna as high up as Delhy, and of the Ganges from Hardwar down to Caunpoor and Futtehghur, will however greatly facilitate the construction of a new and more perfect Map of these Countries than has hitherto been laid down [I, 58, 232].

The late arrangement with the Nabob of Oude, in consequence of which our Troops have been distributed over the greatest part of his Dominions, to supply the place of his own disbanded irregulars, seem to suggest the propriety of procuring a more exact survey of all the roads between the several Military stations than has yet been taken [27]. Indeed there are few of these roads which have ever been surveyed, and some have not even been laid down in the Maps at all.

A survey upon a large scale that should exhibit the several Roads and Military stations in question would be highly useful in a Military point of view, and when reduced to the scale of an ordinary Map would supply what is wanting to complete the Geography of those Parts[5].

No officer was available for a general survey of this nature, and Colebrooke wrote again three years later ;

The conquests which have recently been achieved by the British Arms in Hindoostan having opened a new Field for geographical Inquiry, and as it is desirable to procure a more correct Survey of the newly Conquered and Ceded Countries than had hitherto been obtained, *Lt. Colonel Colebrooke* begs leave accordingly to offer *himself* for conducting a new Geographical Survey, the Objects of which would be the following ;

First—To Survey or, where that might not be practicable, to ascertain from correct *local* information and by detaching occasionally two Native Assistants, who should be properly instructed [29, 30], the Extent and Boundaries of the several Provinces acquired for the Hon'ble Company since the commencement of the Mahratta War [268].

2ndly.—To Survey such routes throughout the Conquered and Ceded Provinces as have not hitherto been surveyed. ...

[1] 54 N/1. [2] DDn. 82 (120), 6-2-10. [3] ib. (91), 31-1-10. [4] *Ben Regr.* 282 (88). [5] DDn. 67 (52), 23-6-01.

3rdly.—To Survey on the same scale such Rivers as have been but imperfectly, or not hitherto, surveyed. ...

4thly.—To ascertain by Astronomical Observations the Latitudes and Longitudes of the Principal Cities, Forts, and Towns, in the Conquered and Ceded Provinces, including the Cuttack Province, the results of which being published in the Asiatic Researches might be useful to future Surveyors and Geographers[1].

Nothing could be done owing to the order for rigid economy [5], but Colebrooke was persistent, and in 1807 again offered

to proceed myself upon the proposed Survey. ... I would engage to perform all that is most desirable for completing the Geography of the Ceded & Conquered Provinces within the space of Eighteen Months, including a Survey of the Jellinghy River and of a considerable portion of the Ganges, which would lie in my way, and also a Survey of part of the province of Cuttack, which I would propose to visit on my return[2].

This time it was resolved that,

as the Service of Lieut. Colonel Colebrooke...can be dispensed with at the Presidency at present, it is highly advisable that the whole of the Surveys referred to should be completed by that Officer as soon as may be practicable[3] [5],

He left Calcutta on 14th April 1807, and travelled through the Sundarbans to Dacca. Keeping surveys of the water highway all the time [22–3], he reached Patna early in July, writing from there to the Resident at Lucknow ;

Having been deputed...on a General Survey of the Upper Provinces, and considering that a new Survey of the Goggra River will be highly useful, ... it is my intention to proceed up that River as high as I can go.

I request therefore that you will...obtain His Highness' permission, ... and likewise... his sanction for my marching by Land through His Country after the rainy season is over, and for detaching two or three Native Assistants in different directions to Survey some Cross Roads which have not hitherto been explored[4].

The following extracts are taken from his letters and journals ;

July 14th. I set sail and proceeded 9 miles up the Goggra. ...

21st. Entering the mouth of the Rapti[5], sailed about 4 miles up that river. ...

22nd. Proceeded up the Rapti[6].

Goruckpoor, 26th July. I have the honour to acquaint you with my arrival at Goruckpoor, having surveyed the Goggra River from its confluence with the Ganges to the Mouth of the Rapti, and the Rapti to this place.

I have reason to believe, from the great disagreements I have found with our best Maps, that no good Survey of the Goggra had ever been made before, and that, with respect to the navigable part of the Rapti, no Survey of it had been attempted before.

I propose to Survey this River a few miles higher up, after which I shall resume the Survey of the Goggra, and continue it as far as I can find water for my Boats, which I expect will be to the Latitude of 29 degrees, and if I do not meet with opposition from the Nepaul people [31] probably to the foot of the Hills. ...

After this I intend, should it not be too late in the Season, to Survey the Goomty River from Lucknow to its outlet below Benares, which I have reason to believe has never been satisfactorily done before[7].

August. ... On the Rapti. ... [Theodolite bearings to snowy Peaks, with pencil profiles] [38].

August 10th. Arrived at Rajpoor at the mouth of the Rapti at 8 o'clock. There I was obliged to wait some time to get the rudder head of my pinnace repaired, and to make some other arrangements preparatory to my proceeding up the Gogra. At 2 o'clock we left Rajpoor and sailed up the Gogra. ...

August 13th. This morning I wanted to take the breadth of the river by trigonometry, as in this part I wished to be very particular and minute, it being the Ghaut or ferry between Benares and Gorackpoor. I then sent one of my native assistants to Gopalpoor. ... As the man did not return until 11 o'clock I waited until he and the men who drove the perambulator had refreshed themselves before I went on[8]. ...

Fyzabad, 23rd August. I arrived yesterday at Fyzabad, having surveyed the Rapti River to about 25 miles above Goruckpoor, and continued the Survey of the Goggra to this place. ...

From the difficulty I find in navigating this River, which is full of Rapids & Shoals, I apprehend that more time will be required to accomplish the Survey of it, than I first imagined.

[1] DDn. 67 (512), 27–12–04. [2] ib. 81 (61), 12–3–07. [3] BMC. 19–3–07 (115). [4] DDn. 81 (84) 6–7–07. [5] 63 N/10. [6] Journal, DDn. 79. [7] To Mil. Dept., DDn. 81 (88). [8] Journal, DDn. 79.

... I have already, by the help of my native assistants procured Surveys of the Roads from Benares to Goruckpoor, and from Goruckpoor to Bansey[1], ... which had not previously, at least not satisfactorily, been laid down[2]. ...

September 2nd. Near this place is a large town called Hazratpoor, the capital of a district, but which has unaccountably been left out of the maps. This omission is the more extraordinary as this part of the country has been long frequented by our countrymen in their way to Lucknow[3]. ...

Byramghaut[4], 5th September. I purpose to proceed from hence on the 7th Instant, and to continue the Survey as high at least as where Captain Wood...surveyed a part of the Goggra River...while surveying the Nawaub's boundary in the year 1802 [26], but shall carry it up higher if practicable.

The difficulties of proceeding beyond where he went I understand, however, to be very great owing to the thick entangled Forests, infested by Tigers and wild Elephants, through which the Goggra flows soon after its descent from the Mountains, as well as the unwholesomeness of the Jungles at this Season of the year[5]. ...

10th. Sailed up the ... Branch of the Goggra which we entered yesterday evening, and which I understand communicates with the Goggra at a distance of 10 or 12 miles above. This branch is not laid down in Major Rennell's maps, nor indeed does the Goggra River appear to have been surveyed at all above Byramghaut. I except, however, a part of the river which was surveyed by Captain Wood[6]. ...

Sicrora[7], 24th September. Having left Byramghaut on the 7th instant, I proceeded up the Gogra about sixty miles beyond that place when, finding the river extremely difficult to navigate on account of the extensive grass jungles infested by Tigers, which cover the Islands and line both sides of the River, I was compelled against my inclination to return, completing however, as I dropped down with the stream, the Survey of that part of the Gogra which lies between Mullahpoor[8] and Byramghaut, and which I have reason to believe, from the eager curiosity which the Natives expressed to see me and my Boats, no European has ever navigated before.

It was my particular wish and intention to have ascended the Gogra a few miles higher up, so as to have reached Mahturaghaut[9] where Captain Wood...crossed that River, ... but the Boatmen were so alarmed by the numerous prints of Tigers of eleven feet in the sand, some of which I saw, and by the smell which occasionally came from those parts of the Jungle where the Tigers then were, or had recently been, that I determined no longer to risk the lives of my people. ...

Had the season proved more favourable with respect to rain and Easterly Wind, I could easily have sailed past the Tiger Jungles, and probably penetrated 100 miles higher up the Gogra, almost to the foot of the Hills. As it was, I surveyed that River 300 miles from its confluence with the Ganges. ...

After staying two days at Byramghaut on my way down, I left that place on the 21st, and, entering the mouth of the Surjou River[10], Surveyed it to within two miles of this station, there not being Water sufficient for my Boats to proceed further. ...

From Mullahpoor I despatched one of my Native Assistants to Survey a Route to Mohamdy, ... Lucknow, ... Purtabgarh, and Benares ; at which latter place I hope myself to arrive by the middle of October[11].

September 24th. Rode out on an elephant to reconnoitre the cantonments and town of Secrora and environs. This is a considerable place, which appears to have acquired importance only from its becoming a station for our troops which it has been for about four years.

This evening about four o'clock I saw a comet very distinctly bearing about west, and at the elevation of about 15° from the horizon.

25th. Went out again on the elephant and drew a geographical sketch of the village of Secrora, the cantonment, and part of the river Sarjoo. Observed the latitude by a meridian altitude of the sun which was 25° 5′ 30″. ...

28th. Reach the city of Oude[12]. [long description]...

10th. October. Rejoined the Ganges[13]. ...

15th. Arrived at Buxar, once a fort of some importance, but is now garrisoned by invalids. ...

[1] Bānsi, 63 I/16. [2] To Mil. Dept., DDn. 81 (91). [3] Journal, DDn. 75. [4] 63 E/8. [5] To Mil. Dept., DDn. 81 (93). [6] Journal, DDn. 75. [7] now Colonelganj, 63 E/12. [8] Mallahpurwa, 62 H/4. [9] Matera, 62 H/4. [10] or Chauka R., 63 E/7. [11] To Mil. Dept., BMC., 12–10–07 (69). [12] Ajodhya, 63 J/1 ; *v. Imp Gaz. U. P.* II (388). [13] below Chapra, 72C/14.

18th. Reach Ghazipoor. It was here that Lord Cornwallis died on his way up the country in October 1805[1]. ...

On October 25th he reported his arrival at Benares;

After leaving Secrora on the 26th ultimo, I fell down the Gogra, making such additional observations on my way, as...would be useful for completing a New Chart of that River.

At Oude on the 29th & 30th September, I was detained by a Violent Storm, and my boats were in imminent danger of being Stove to pieces upon a Sea Shore. Leaving Oude, I continued my voyage to the Mouth of the Gogra where, after escaping some additional Dangers from the Quick Sands with which that River abounds, and upon which my Pinnace frequently ran, I had the satisfaction to re-enter the Ganges on the 10th instant.

On the 23rd I arrived at this place, from whence I intend proceeding on the 30th by the Goomty[2] to Lucknow. ... It is not my wish...to stay longer at Lucknow than will be absolutely necessary for procuring an Escort of an European Officer[3] and fifty Sepoys from Cawnpore, with some Camp Equipage and Carriage Cattle to join me at that place previous to commencing my Survey by Land[4]. ...

November 18th. Allahabad. ...

30th. Cawnpoor. The Country as you approach to Cawnpoor, and immediately about this extensive Military Cantonment, is the most arid, parched, and bare of vegetation, of any I ever saw. ... The Cantonment is now of prodigious extent. ...

December 16th. After remaining a fortnight at Cawnpoor, during which time I was busily engaged in preparations for my March, I crossed the Ganges. ...

21st. Rode into Lucknow, and arrived at...the British Resident's House. ... The road, considering it is leading to the Metropolis of Oude, is but indifferent[5].

January 6th 1808. Khyrabad[6], having left Cawnpore on the 17th ultimo, and Lucknow on the 2nd instant.

From Cawnpore I deputed one of my native assistants to survey a New Route to Muttra, with instructions to proceed from thence direct to...two Forts...not hitherto...inserted in any of our Maps. He will proceed from thence to Bareilly...where I expect to meet him about the end of this month.

Another of my native assistants has lately Surveyed a Route from Benares through Juanpoor[7], and along the North side of the Goomti to Lucknow, ... Etawah, and Cawnpore[8]. The same man has also Surveyed a Route from Lucknow...and I am about to send him, with a Naick and seven Sepoys for his protection, across the Gogra...through the Keyreegur District[9] to...Bunbussa Ghaut, where I am myself proceeding in the hope of penetrating to the Spot where the Gogra issues from the Mountains[10] [26].

January 17th. On my arrival at Bareilly I was received with great politeness and hospitality by Mr. Crisp, the Magistrate of the District[11]. ...

23rd. At Pillibeet. ...

February 7th. Marched at Sunrise and attempted to proceed in a North-Westerly direction to the Hills, but we were soon brought up by a Swamp in a high grass jungle which baffled all our endeavours to get on in that direction. The Elephants began to sink in the mud, and I was obliged to alter my course to avoid the danger of losing some of our Elephants and Camels. ... We then turned to the South, and skirting the edge of the Forest soon came to a tolerable road ; ... we reached the village of Pipria where we encamped. ...

11th. Having caught an intermittent fever and sore throat, I was obliged to halt this day. ... Some Hill people who came to see me out of curiosity gave the following route to Almora[12]. ...

Moradabad[13]. February 17th. I have the honour to acquaint you with my arrival at Moradabad, having surveyed a new Route from Sheetapoor[14]...to Bareily, from which place... I proceeded in a N. Ely. direction, through Pillibeet to discover the place where the Goggra River breaks through the Mountains. ...

From Pillibeet the Road to it is easy, and the country tolerably free from Jungle as far as Beelaree, a distance of 26 miles. ... Near this place the Nepal Government have a post, the Sirdar of which...levies a Tax upon all articles which are brought down from the Hills. I conceived that the previous consent of this man to my passing his post would be necessary, to enable me to proceed to the Falls of the Goggra ; I therefore sent him a message to that effect, to which he returned a Civil answer, acquiescing in my proposal.

Having visited Bunbussa Ghaut, a ford of the Goggra, ... I proceeded next day (28th

[1] Journal, DDn. 79. Lord Cornwallis returned for second tour as GG. with policy of peace and economy, but died within a few months of landing. [2] Joins Ganges 63 O/3. [3] W. S. Webb [27]. [4] To Mil. Dept., BMC. 2–11–07 (68). [5] Journal, DDn.80. [6] 63 A/14. [7] Jaunpur, 63 N/8. [8] MRIO. 32 (74–7). [9] Kheri, 63 A/13. [10] To Mil. Dept., BMC. 18–1–08 (78). [11] Burtish Crisp (1764–1811); BCS. 1778 ; father of J. H. Crisp (1788–1870), Mad. Inf. & Survr. [321]. [12] Journal, DDn. 80. [13] 53 L/13. [14] Sitāpur, 63 A/10.

Ultimo). ... Jewanund met me within a Short distance of His Post, and presented me with a Nazur of a pod of Musk. His Behaviour was courteous & Civil, though somewhat constrained, which might have been owing to the consciousness he felt of being within the Company's Boundary. ... After a few minutes conversation he took his leave, when I presented him with a piece of Scarlet Cloth, and a Spying Glass, with which he seemed well pleased.

Pursuing our route...we encamped in the forest, on the Bank of the Goggra, which here rushes over a bed of Stones & pebbles with considerable velocity and some noise. The Scenery here is very wild, and the forest, particularly on the East or opposite side of the River, is said to be full of Tygers & Wild Elephants. We were now within 4 miles of Burrumdeo[1], the place where the Goggra issues from the Mountains, & next morning we succeeded in getting there & ascertained its geographical situation. The Scenery in approaching it was very grand, but a heavy Shower of Rain, which continued nearly the whole time we were out, prevented my taking any views.

On our return to Camp the rain increased and lasted all night, which made me anxious, having accomplished the main object of my journey through the forest, to get out of so uncomfortable a situation. After drying the Tents the next morning we accordingly returned to Belaree.

The party now marched westwards, keeping as close to the hills as possible, and, at the village of Peepurhatty, we suddenly met a party of Mawatties who, probably thinking that we were in pursuit of them, ran off into the Jungles. I did not learn that they had recently committed any particular Robberies, but I understood that they levy undue exactions from the Hill people who graze their Cattle in this part of the Country, and lay a tax upon all the Timbers which are cut in the Forests.

A very thick Forest abounding in very large Sall Trees occurs between Peepurhuttee & Suckutpoor & here also Wild Elephants are frequently caught.

From Suckutpoor my route was continued...to Kuthie, ... beyond which I found it impracticable to proceed in the direction of the Hills owing to a swamp, which, as it was said to be two or three Kos in length, there would have been a risk of losing some of our Elephants or Camels. I determined then to proceed by a more circuitous route, ... keeping the forest at some distance on my right, ... when, having been attacked by an intermittent fever, I returned to Kasheepoor[2] with a small part of my Escort, leaving Lieut. Webb [31 n.3] to follow me by way of Sherkot[3] to Moradabad, ... which he readily undertook to survey in my absence.

I proceeded in three easy marches from Cossipoor to this place and, my fever having left me, I was enable to Survey the road the whole way[4]. ...

23rd February. Rode into Moradabad to visit the Ruins of Poorhain Khan's Fort, of which but few vestiges now remain. It stood on the Bank of the River, commanding a fine prospect of the River & country around.

There the late Mr. Reuben Burrow, about 20 years ago made his observations for the Latitude & Longitude [I, 161] and I endeavoured to ascertain from some of the oldest inhabitants, who I thought might remember him, the identical spot where he observed, but they could not inform me. ...

28th. After observing the bearings of the snowy mountains, many of which were visible this morning [86–7], we marched to...Jafferabad Ghaut, where we crossed the Ganges[5]. ...

Meerut, 2nd March. ... I left Moradabad on the 24th ulto. and have continued my Survey... to this place.

In my last Letter I informed you that an attack of the jungle fever had induced me to proceed to Moradabad sooner and by a more direct road than I had intended, but that Lieut. Webb would continue the Survey...by a route more circuitous to that place.

He arrived there accordingly on the 21st ulto., having performed that part of his Survey entirely to my satisfaction. From the time indeed of his joining me, Lieut. Webb has carried on a Survey with a perambulator and compass, besides frequent Observations for the Latitude which, had I not been with him and engaged in the same occupations, might have been perfectly sufficient for any Geographical purpose. ...

My own health being, since the fever...which has been followed by a severe Bowel complaint, but indifferent, I begin seriously to apprehend that I shall not only be obliged to relinquish the proposed Journey to Gungoutri [73], but that I may likewise be compelled to give over surveying altogether, at least by land, sooner than I intended[6].

March 3rd. The city of Meerut is large and populous & is surrounded by a Wall, as are most Towns and villages in this part of the country. The reason of it, I suppose, is that they

[1] Baramdeo, 62 C/4. [2] 53 K/16. [3] 53 K/11. [4] To Mil. Dept., DDn. 81 (113). [5] Journal, DDn. 80.
[6] To Mil. Dept., DDn. 81 (119) & BMC. 21-3-08 (79).

had formerly been subject to the incursions of the Seeks and Mahrattas long before the latter had got possession of the Dooab, but even then the numerous Tribes of Jauts, Goojers, and Mawattee plunderers kept them in perpetual alarm. The Country is now comparatively very quiet, and the mild influence tempered with justice of the British Government has spread universal peace in these provinces. ...

11th. Reached Delhi[1]. ...

Delhi. March 26th. Since I last had the honour to address you from Meerut, which place I left on the 9th instant, I have surveyed the Route from thence to Delhi, but owing to the continuance of my complaint which has been accompanied with a soreness in my eyes, I have not been able, since the 12th instant, to resume the Survey[2].

Whilst at Delhi Colebrooke received permission for Webb to explore the sources of the Ganges [74];

Whenever the state of your health, or other circumstances, may render it necessary for you to relinquish the prosecution of the Survey in which you are at present engaged, ... the Survey of the Ceded and Conquered Provinces, and eventually of performing the journey to Gangoutri, shall be assigned to Lieutenant Webb[3].

From Delhi he travelled via Anūpshahr to Bareilly, and halted there to await Webb's return from Gangotri ;

May 20th. ... Since my arrival at Bareilly on the 17th Ulto. I have been busily employed in arranging and constructing some of the numerous Routes which I have either surveyed myself or procured through my Native Assistants since my arrival in the Upper Provinces[4].

These when all carefully laid down and combined with the materials which had formerly been collected will...furnish a very extensive and valuable Map, but which will necessarily require a considerable time, and much laborious application, to complete[5].

June 18th. ... Having now nearly completed, as far as was practicable within the time proposed, the Survey of the Ceded & Conquered Provinces in Upper Hindoostan, it is my wish...to return by water to the Presidency, for the purpose of compiling a new General Map of the whole, and to construct a set of Maps more detailed of such Provinces or Zillahs as have been best surveyed[6].

Having welcomed Webb back to Bareilly on June 30th, Colebrooke set out once more by river on August 1st, keeping up a continuous survey down the Ramganga to its junction with the Ganges, besides working some distance up its tributary the Dewah[7]. He wrote on August 30th reporting his

arrival at Cawnpore, being thus far on my return to the Presidency, though I am sorry to add in an indifferent state of health, owing to an attack of the Dysentery, with which I have now been troubled two months[8].

This was the end of Colebrooke's life work as a surveyor ; his illness grew worse, and he died at Bhāgalpur on September 21st 1808 [5].

The surveys which he had so conscientiously carried out during his last twelve months were in due course embodied in the maps of the Upper Provinces, and copies were sent home to the Directors in 1812.

OUDH & GORAKHPUR, 1808–14

Before his death Colebrooke had arranged for Webb's appointment as "Surveyor in the Upper Provinces"[9], with orders to finish off certain main routes in Oudh, and take up the survey of Gorakhpur District. Webb had remained at Bareilly to work up his reports and maps of the Gangotri-Badrīnāth expedition [76], and Colebrooke wrote to him from Cawnpore ;

With regard to Instructions, I can transmit them to you from Benares, or even from Calcutta, as you will most likely not be able to commence your operations for six weeks or two months to come.

I can suggest, however, ... one route to begin with, which is the high Road from Lucknow to Juanpoor ; 2nd.—from Juanpoor through Azimgur to Goruckpoor ; 3rd.—from Goruckpoor by way of Captaingunge[10] & Sicrora [30] to Lucknow.

[1] Journals, DDn. 73 & 80. [2] BMC. 25–4–08 (67). [3] ib. 21–3–08 (80). [4] Original maps and compilations ; MRIO. 25 (57–64) 29 (39, 40, 43) ; 30 (44–51, 67–87) ; 31 (3–21) ; 32 (62) etc. [5] To Mil. Dept., DDn. 81 (139). [6] ib. (144). [7] Journal, DDn. 73. [8] BMC. 5–9–08 (54). [9] BGO. 4–7–08. [10] 63 J/10.

Of this Track some parts have been surveyed, though indifferentiy ; ... it is impossible indeed, in surveying, to avoid going over some tracks which have been surveyed before ; but in such cases the Surveyor should not relax, or omit anything, as it is probable that his Survey might furnish corrections which would always be of use.

The Latitudes of all the principal places in this Route will be useful, indeed some are much wanted[1].

Webb surveyed this route during October and November[2] and then, at the request of the Resident at Lucknow[3], took up the general survey of the eastern frontier of Oudh that had been left incomplete by Smyth [27], receiving instructions from the Surveyor General with

a sketch of the Surveys made in, and on, the boundaries of Gorackpoor by Captain Wood and Lieutenant Smyth, ... to prevent your going over the Ground already surveyed by those Officers ; all the other parts of this Province appear to have been laid down from reports, not from actual Surveys. It will be proper to have the Surjoo surveyed as high up as possible, and the Places on both sides of the River noted, particularly where other streams fall into it, and where it changes its name to the Gograh[4]. Also...the distance it is navigable, and for what size Boats.

It is a desideratum to know what quantity and species of Timbers grow on its Banks, whether they are easily procurable, and to be transported, or not[5].

Webb spent two years on these surveys, completing a map of "The Gurra River[6] from the Mountains to its confluence with the Ramganga River", and also one of the "Gogra from near Fyzabad eastward to Sultanpur", besides many routes[7]. One of his earlier maps shows "Forests where Elephants are caught", along the belt of *tarai*[8] [40 n.3].

He completed most of the blanks along the eastern boundary of Oudh, and the main routes between Jaunpur, Fyzābād, and Lucknow, and the country to the north[9]. During 1810 he surveyed the cantonments of Lucknow, Secrora, Sitāpur, and Bahramghāt, "being much interrupted by heavy falls of rain[10]" [28, 61].

Towards the end of 1811 his health broke down, and he obtained leave to Europe, the Surveyor General writing ;

I was in hopes from His former communications that He would have completely finished the whole of these boundaries, but there is often a wide difference between the Estimates of what Men can do and what they actually Survey, even when made by the most industrious Surveyors, amongst which class Lieutenant Webb must in justice be reckoned. ... His surveys appear to be accurately laid down ; his drawings are neat, and shew that great pains has always been taken to give satisfaction[11]. ...

The continuation of Lieutenant W. S. Webb's Surveys in Oude...are very valuable for the accuracy and neatness with which they appear to have been compiled, and is very creditable to that officer[12].

Webb had done but little work in Gorakhpur district, and Garstin sent in,

a rough drawing, ... to shew the Lines that have been measured. ... In the original surveys on each side of these Lines, for the distance of four or five Miles, the villages in sight have been inserted, but nothing more has been effected. There are many passes into the Hills, from which in case of disturbance the Inhabitants of the Mountains might make excursions into the Plains, carrying destruction in their Train, and return with impunity, from our want of Knowledge of the Roads leading to their fastnesses. These appear to me to call for examination, and the purposes of the Revenue and Police will be considerably advanced by having an accurate Survey of this valuable Province completed[13].

Benjamin Blake had already been surveying routes in Gorakhpur[14], and from April 1812 was appointed to survey the whole district, with the following instructions [366] ;

When you arrive...near the junction of the little Gunduck and the Dewah[15], about Ten miles beyond Durrowly[16], you will proceed up that River...carefully noticing all its windings, ... and determine the boundary of the Province where it joins Sircar Sarun[17]. ... Having

[1] DDn. 82 (50), 26–8–08. [2] ib. (46), 23–11–08. [3] B Pol C. 10–4–09 (86). [4] noted by Colebrooke 18 months earlier [30]. [5] DDn. 81 (76), 11–3–09. [6] Girwa R. joins Sarda, 63 E/8, the combined rivers becoming the Gogra. [7] MRIO. 168 (1, 26–8) ; 30 (18, 26). [8] ib. 25 (33–4). [9] ib. 17 (16, 20). [10] Fdbks. MRIO M 352–3, 387. [11] DDn. 128 (57), 7–3–12. [12] ib. (84) 8–9–12. [13] ib. (57), 7–3–12. [14] BMC. 4–4–12 (106). [15] or the Gogra. [16] 72 B/4, *v. Ben. Atlas* x. [17] Sāran Dist., 72 B.

correctly laid down the Eastern Boundary, the next object will be the exploration of the Range of Mountains forming the Northern Limits, and a most careful and correct Survey must be taken of the whole border.

Not contenting yourself with seeing that there are passes, you must go thro' them, and carefully remark their Breadth, also note whether Cavalry and Guns can either ascend or descend thro' them ; if the roads can be made passable or not ; and endeavour to obtain some correct information of the Nature of the Country above the Gauts[1].

Blake never reached these northern borders, and two years later Crawford complained of his slow progress [201, 219–20] ;

As you have now been a very considerable time employed upon the Survey of the Goruckpoor Province, ...you will report to me when you will be able to forward your labours to this Office, as the survey cannot be extended beyond the approaching rains.

I have looked in vain among your Field Books[2] for a Latitude, an Azimuth, or Amplitude ; I hope and trust, however, you have regularly taken them.

I see no remarks either of the nature of the Country you pass thro', with the exception only of once or twice, "Very Woody" nor do I see any notice taken of the interior divisions of the Provinces. ... Having surveyed through the District in a zigzag Direction myself [27], and having received Lieutenant Pickersgill's late Survey [38–40], I have a tolerable idea of the Carte du pays[3].

I find to my surprise that you are on the Benares side of the Gogra. ... In my letter of the 16th of March I mentioned the Survey could not be prolonged beyond the setting in of the Rains, and must confess I was not a little surprised to find in your answer that you required a whole year beyond that ; but if you survey at the rate of 4 Miles a day, and go into other Provinces, it is impossible to say when there would be an end to such surveying. ...

I do not think Government will allow another year beyond the approaching Rains, as it would be paying more for a map of Goruckpore than it is worth, particularly as we have a tolerable idea of it in the Office already[4].

I surveyed from Purneah to Hurdwar in 4½ Months, a distance of 1000 miles [27], and during that I never took less than 15 observations a day, and often 20 to 25, and on the days of halting more. As I surveyed a considerable track through the Province of Goruckpoor, I am very anxious to see if your latitudes and mine agree[5].

At the end of 1814 Blake was called off to rejoin his unit. In spite of Crawford's strictures his map was a valuable one, crowded with place-names[6].

GANGES–JUMNA *Doāb*, 1811–4

In submitting a map for the use of the Commissioners of the Ceded and Conquered Provinces in 1810, the Surveyor General called the attention of Government to the Map of the Northern part of the Zemindary of Benares, ... of which we scarcely have the smallest knowledge ; it remains almost a Blank space in our Maps and, although I have carefully searched the records of the office, I can find no materials to construct a better. The late Colonel Colebrooke had made a fruitless search for the same purpose. It has been in these unexplored parts that several troublesome Persons such as Jaggernaut Sing raised the Standards of revolt, and our want of knowledge of the Country enabled him for a considerable time to avoid the search made after him[7].

A year later William Stephen [25] was sent up to Ghāzīpur with a "Sketch of Major Wilford's Map of the Northern part of the Zemindary of Benares[8]" ;

You will by the Dawk Bangey receive Two Skelleton Maps of that part of the Province of Benares which is first required. The large one will shew the different Pergunnahs whose boundaries should be as carefully ascertained as possible.

I think the best mode of conducting this Survey will be to measure a Base from Ghazipoore by Mow to Doory Ghaut[9] on the Gograh or Dewah River, and then to survey the space to the southward comprehended between the line of the before-mentioned River and the Ganges[10], carefully laying down the several...Nullahs, ... as well as the Roads, Towns, Villages, etc., ... to a scale the same size as the Map transmitted.

[1] DDn. 126 (146), 25–4–12. [2] MRIO. M 354–6, 515. [3] DDn. 131 (37), 16–3–14. [4] ib. (57), 11–5–14. [5] ib. (106), 14–10–14. [6] MRIO. 25 (30), 4 m., (31–2), 2 m. to an inch. [7] DDn. 128 (35), 28–6–10. [8] Survd. 1788–94 ; 3 m. to one inch [I, 43–5]. Benares then covered the present districts of Benares, Mirzāpur, Jaunpur, Ghāzipur, and Ballia [45 n.2]. [9] Ghāzipur, 63 ; O/10 ; Mau, 63 O/9 ; Dohrighāt, 63 N/11. [10] the present Ballia district.

You will almost make a reduced copy of your survey to the Size of the lesser Projection sent in the same Bamboo, ... so as to omit no place of importance, at the same time that Places of no note are not to be introduced in the small map, to avoid confusion[1].

When submitting plans for Sir George Nugent's tour up country the following year [23], the Surveyor General reported that,

the plan of the Ganges between the mouth of the Goomtee and Gogra taken by Ensign W. G. Stephen, Engineer, is a very neat specimen of that officer's work [23, pl. 18] and has enabled me to carry on the Plans, by connecting it with the other Surveys in this office ordered for His Excellency the Commander in Chief in his tour to the Upper Provinces[2].

Stephen was eventually called away to the Nepāl War, leaving his work unfinished ;

I have connected into one map everything lying to the eastwards of the Meridian of Ghazipoor, but all the rest of my survey is on separate papers, just as protracted[3]. ... I propose ...to leave the whole of my protractions...at Benares. In case of accident to myself they can then be sent down to your office just as they are, or made over to the officer who finishes the Survey. ... I should also wish to finish what I have begun and am interested in, and should be sorry were it found necessary to order another officer to complete my Survey[4].

His wish was granted, for he came safely through the war, and went back to finish his survey.

In addition to the route surveys already mentioned [27], there are several by Blake, including the march of his unit from Rewāri to Sahāranpur[5] in November 1809, with an entry "being officer of the day prevents my getting Bearings of the villages in the neighbourhood"[6]. In submitting a "Map...of the Upper part of the Dooab, comprising the Northern Division of Seharunpoor & part of the Thibet Mountains", he writes that,

In 1809 the...Magistrate of the Northern Division of Seharunpoor was particularly anxious to have a correct Map of his District, chiefly with a view to...some arrangements connected with the police of the Country. About this period having leisure, I accompanied [him] during a circuit he made of his zillah for the purpose of visiting the several Thanahs, & of this favorable opportunity I availed myself to make a sketch of the Country[7].

During the next two years he made various

surveys in the upper part of the Do'ab, with the passes in to, and a small part of, the Thibet Mountains, including some Rivers therein, which disembogue into the Jumna. ... November 1809 to March 1811[8].

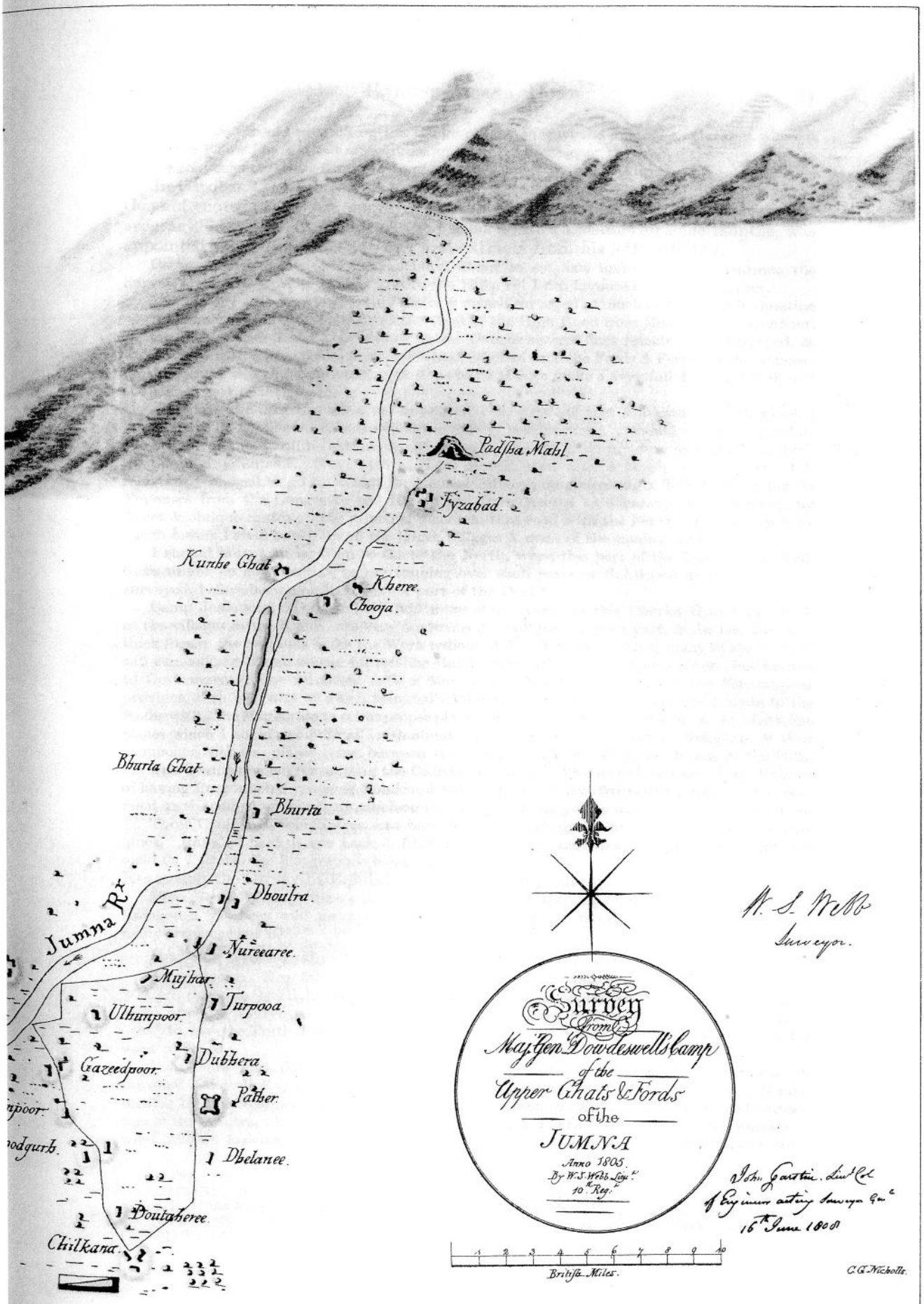
He visited Kālsi[9], where the Jumna breaks out of the hills, and recorded information about the route to Nāhan, capital of Sirmūr, then occupied by the Gurkhas; "from this return to Cantonments by Dawk, the Leave of absence being out". His map[10] gives views of the Siwaliks, and a vague representation of the Dūn, with Dehra and Kalanga Hill [90], and routes reported by Gurkhas travelling through the Dūn to Nāhan. He also made a six-inch plan of Sahāranpur cantonment[11].

In October 1811, after Blake's move to Gorakhpur [34], the Surveyor General recommended the appointment of Francis White [64] to

survey the Upper portion of the Dooab from Futtyghur[12], including Shaharunpoor & Meerut, of which...our knowledge is miserably deficient, excepting on the Banks of the Ganges that have been accurately surveyed by Major Wood [I, 58 ; II, 22, 26], and the Upper part of the Jumna, from the Hills to Delhi by Lieutenant Tod [26]. The other materials in the office do not furnish requisite information, either for military purposes, or for those of Police, still less for the Revenue, & considerable loss is sustained by the Public for want of an accurate Survey[13].

He sent White a map with Blake's recent surveys inserted, and asked him to fill up the Blanks as accurately as possible, correcting it where erroneous. If the corrections are marked in red, I shall be able to appreciate the value of the Materials from which it was composed. The River Jumna from Agra to Kalpy[14] requires particular attention, and you will be pleased to lay down those reaches where the Channel is obstructed on a large scale, so as to show the obstructions clearly, that measures may be taken to remove them[15].

[1] DDn. 126 (105), 14–9–11 (117), 14–12–11. [2] ib. 128 (84), 8–9–12. [3] Fdbk. MRIO. M. 324. Maps, ib. 28 (38 *et seq*). [4] DDn. 136 (120–1) 7–10–14. [5] 53 D/12 to 53 G/9. [6] Fdbk. M. 541; [7] BMC. 4–6–14 (94). [8] Fdbk. MRIO. M. 541. [9] 53 F/14. [10] MRIO. 16 (3) ; 17 (47–8). [11] ib. 185 (9). [12] 54 M/11. [13] DDn. 126 (108), 2–10–11. [14] 54 N/12. [15] DDn. 126 (129), 25–3–12.



Reduced from a copy of Webb's survey [27] made by draughtsman C. G. Nicholls in 1808.

I wish...you would proceed up the Banks of, and survey, the Jumna, to the spot where it enters the Plains [pl. 7], and afterwards...measure a line as near the foot of the mountains as can be conveniently done, from the Jumna to the Ganges at the Hardwar[1].

In October 1813 White had to resign on account of ill health, and the Surveyor General noted that his surveys[2] had been "executed with his accustomed accuracy"[3]. John Hodgson, who had been White's assistant for some months, was appointed to continue the survey[4], and extracts from his letters follow.

Camp Anoopsheer[5]. Oct. 5th. ... I am about to set out immediately to continue the Survey above the parallel of Meerut & to the Hills, till I am favoured with your orders.

During May and June last, Lieut. White & myself surveyed as much of the Tract in question as the Time would allow, & chiefly to the West of the High Road from Meerut to Seharanpour. To the East of that Road & between it & the Ganges several lines remain to be surveyed, as well as to connect the principal places with each other as with the Fords & Ferries of the Ganges; on this duty I will employ myself, ... & hope to be able to make a very full & complete Map of the Upper part of the Doab[6]. ...

And now, my dear Sir, allow me to request your kind support & assistance, with which I hope I may be nominated to succeed to the Survey now vacant; ... should you be so good as to recommend me, I will be extremely obliged, & endeavour to do my duty as well as possible[7].

Camp Seharanpour. Nov. 14th. ... Last Month, soon after I began, I was taken ill & reluctantly obliged to go to Meerut for Medical Advice; on recovering a little I...am going by Traverses from the Ganges to the High Road from Meerut to Seharanpour, connecting by direct & oblique routes all the principal places on that road with the Ferries of the Ganges, by which means I shall sweep up all the larger Villages & most of the smaller ones. ...

I should hope that as I am so far to the North, when this part of the Doab is surveyed, there might be no objection to my running over such parts of Rohilcund as have not been surveyed, before beginning in the lower part of the Doab[8].

Camp Jaalapoor. Dec. 2nd. I find more employment in this District than I expected, as the villages in the Kadir...are very numerous & small for the most part, & the bad Roads & thick fogs in the lowlands make the Work tedious, & I wish to lay down as many of the Villages as I can, as...the Commissioner for settling Rajah Ramdial's Estates, & who is here, has written to Government to be furnished with a Map of the Northern Division of the Seharanpour province, thro' all parts of which Ramdial's Villages are scattered, ... I am going again to the Kadir with...the Magistrate to select proper places for placing our Thannahs in, & to visit some places which I could not before. ... In about a week I shall came round to Munglour, & then commence with the places lying between the Hurdwar and Seharunpoor Roads & the Hills.

The Commissioners for settling the Ceded & Conquered Provinces [35] are very desirous of having Purgunnah Surveys of Rohilcund & other parts, & have frequently applied to Government on the subject without any satisfactory Answer. I fancy they will repeat the application.

Three Companies which were sent here drove the Insurgents into the Forest & all is now quiet. Ramdial paid us one Lack & 1,200 Rs. yearly & I understand a light assessment will yield us 7 Lacks, the low grounds being fertile[9].

Regarding the survey of Rohilkhand, Crawford replied;

Since Rennell's maps were published, Rohilcund and the country between the Ganges and Ramgonga has been well surveyed; Col. Colebrooke, Major Wood, and myself have carried many tracks across it[10].

Hodgson wrote again;

Seharanpour. Dec. 5th. ... As I am surveying by Circuits, it is necessary to have the Western side, i.e. the High Road from Meerut to this place...laid down by myself, tho' I know it has often been surveyed (or measured at least), so I have come up here from Muzafarnaggur (tho' to say the Truth I was obliged to come thus, ...my Horses not being able to travel for want of Shoes).

I shall now work down to the S.E., & take up my Circuits in the Districts lately held by the great Goojer[11] Rajah Ramdial Sing who is dead, & the Country having reverted is now settling by Mr. Chamberlayne[12] at Munglore, who has been in some jeopardy from the Insurrection of the Goojers, who had killed one of the Canungos & 2 of the Corps of surveyors (Jureebs); what military assistance could be spared from this place has been sent to Munglour, & 3 Com-

[1] DDn. 126 (153), 2–6–12. [2] Fdbks. MRIO. M 346; Maps, ib. 16 (4, 16–7); 29 (2, 16); 160 (14). [3] DDn. 143 (32), 23–3–14. [4] BMC. 30–10–13 (71). [5] 53 L/7. [6] Map of Delhi, Meerut, Bulandshahr, from survey by White & Hodgson, engraved, 4 m. to an inch, *Ben Regr.* 288 (139). [7] to SG.; DDn. 130 (89). [8] ib. (97). [9] ib. (121). [10] DDn. 131 (8), 22–12–13. [11] a gipsy tribe. [12] Robert Chamberlain (1787–1819), BCS.

panies are hastening up from Merat, but I think it likely that a much larger force may be necessary ere a Settlement can be made with these Goojers, who are a desperate Tribe. ... The Commissioner is hastening, & I trust his experience may set matters to rights, or my surveying among those Villages may prove not very pleasant[1].

The Commissioner wrote shortly after ;

The map of this district in the office of the Board of Commissioners being exceedingly defective, having been formed before the conquests, and the limits of the Tehseeldaree Jurisdictions having, in consequence of the want of due local information, been in some cases injudiciously arranged, I take the liberty to...request to be furnished with a correct map from the office of the Surveyor General [36, 180][2].

The extension of Hodgson's survey into the Dūn and the lower foothills is described in a later chapter [82–4].

NEPĀL WAR, 1814–6

During the early years of the 19th century the Gurkha nation had been expanding vigorously towards the west, and had overrun the hill districts of Western Nepāl, Kumaun, Garhwāl, the Dūn, Sirmūr, and the Simla Hills, besides encroaching southwards into the plains of Butwāl, Champāran, and Gorakhpur [1, 5, 39–40]. The Governor General's Agent at Bareilly wrote in 1811 ;

The encroachments of the Nepalieze on our frontier appear, from the Magistrate's reports, to be of more considerable extent, and of much longer standing, than I was at first aware. ...

The local situation of Pergunnah Khyree Ghur[3], which occupies a considerable tract of unexplored country, ... will account for the period which has elapsed without the magistrates having obtained an earlier notice of these encroachments. ...

From the inconvenience which results in a discussion of boundaries without a map to refer to, permit me to solicit the favour of being furnished with one of the Ceded and Conquered Provinces from the Surveyor General's office, including the corrections & discoveries made by the late Colonel Colebrooke and the engineer officers employed under his authority[4].

In January 1813 Major Paris Bradshaw[5] was deputed to investigate these encroachments, and Government directed that,

as it is...desirable to obtain some accurate Geographical information respecting the disputed lands, an Officer who may possess some knowledge of Surveying will, if possible, be selected for the Command of your Escort[6].

Joshua Pickersgill was selected, Bradshaw reporting that,

Altho' Lieutenant Pickersgill professes no particular talents for Surveying, yet, as he has been accustomed to keep routes and make surveys on any movement of his Battalion, and being the only officer, either at Goruckpore or Sicrole, who appears to have any knowledge of the nature required, he has considered him best calculated to meet the wishes of Government[7].

Nepalese Commissioners were appointed to meet Bradshaw and, whilst comparatively friendly, but entirely fruitless, discussions were carried on for several months, Pickersgill surveyed the areas of Butwāl and Sheorāj[8] that were in debate, working right through hot weather and rains.

The Field Book which I kept last year [1813] was commenced on marching from Siccole, and kept with proper correctness, but the objects to the Rt. & Left were shewn at computed distances. It was impossible for me to do it trigonometrically while marching 12 and 14 miles a day. The Survey of the disputed lands was made in the same style. The total Distance travelled on that occasion was 144 miles 3¼ Furs., which was performed in 14 days at an average of 10 m. 2½ F. per day ; this was in the month of April.

The compass was scarcely out of my hand the whole time. A copy of the Survey...was finished in 7 days, and forwarded by Major Bradshaw to Government. ... In making out these Plans it was necessary to sacrifice embellishment to dispatch, but accuracy was never lost sight of. ... I was therefore careful to separate the Seen from the Unseen, not that the latter should be undervalued, for it was the result of much laborious inquiry[9].

In December the Commander-in-Chief urged

[1] DDn. 130 (117), 5–12–13. [2] ib. 129 (137), 28–12–13. [3] 62 D/15. [4] B Pol C. 3–5–11 (47). [5] Ben. Inf., Ens. 1781 ; Lt Col. 16–12–14 ; d. Bankipore, 9–8–21. [6] B Pol C. 15–1–13 (46). [7] ib. 26–2–13 (43). [8] Butwāl, 63 M/6, ceded to Nepāl, 1816 ; Sheorāj, now a *tahsil* of Nepāl, 63 I/14. [9] Pickersgill to SG. 17–3–14, DDn. 130 (175) ; B Pol C. 21–5–13 (19).

the necessity of having a regular and continued Survey taken of the British frontier between ...the North Western limits of the lands of Bootwal and Sheoraj to the [Coosah] river[1]. ... The tract...must...include all the principal routes and avenues leading into the territories of Nepaul, and would probably form the immediate scene of operations, in the event of a rupture with that restless and encroaching Government[2].

Pickersgill was accordingly relieved of command of the escort and appointed Surveyor under the professional orders of the Surveyor General, who thus defined his first task ;

In extent it is to include the Road from Butwul to Goruckpoor...to the Eastward, and to extend to the Boorah River[3] to the West.

As this Map is expressly wanted for Military purposes the scale ought to be a large one, 1 mile to the inch, as it would by this means enable you to include every local information requisite for troops to be in possession of.

The best way for you to proceed would be to lay down all your former survey on that scale, as a ground work to act upon. ... Every Road that leads from the Hills into the Province of Goruckpoor ought to be carefully examined and laid down, ... but the most material part of your survey will be to accurately lay down and define the Nepaul Boundary from the Neighbourhood of the Palee[4] to the Boorah River.

As the Nepauleze have neither Artillery or Cavalry, their inroads are always made by Infantry unincumbered with heavy baggage, and of course can make their approaches by every footpath ; it will therefore be particularly desirable that you make inquiry after every track that such troops can come in by[5].

The following notes and extracts are taken from Pickersgill's fieldbooks and letters ;

[Survey opens December 22nd 1813, from Biteea ; follows along the border, pointing out encroachments].

Jan. 2nd, 1814. An encroachment on the part of the Nipalese of about 6 years standing being one of the objects of examination before Major Bradshaw, I was directed by that officer to trace the Boundary as it stood before the term specified above. ...

[March 27th. Does a short length of triangulation up the bed of the Gandak, to fix the point where it issues from the hills][6].

Camp Khujjorah, April 4th 1814. ... The accompanying public letter will acquaint you with the difficulties I have experienced in the outset of the Survey of the Boundary. ...

Amar Sing honored the Escort attending my Survey so highly as to recal two companies to Bootwal on my arrival at Nichlowl[7]. The Survey is tending towards the former place at the very moment that both sides appear determined to unmask. There, with Twenty sepoys, I shall stand in the face of the Nepal Army, 80 miles from succor. As the Survey is a Military one, you may depend upon it being conducted with a Military Spirit, but should it be suddenly diverted into any lateral route, I hope you will believe that I am actuated by motives of Prudence[8].

During April a detachment of the Company's sepoys established police posts in Sheorāj and Butwāl, and withdrew during May. On the 29th May the police posts were attacked by the Nepalese and their garrisons murdered. Pickersgill was in considerable danger ;

May 31st. Nugra, on the Ballooa River. Here the further progress of the Survey was interrupted by the arrival of the Thanadar, ... who had survived the general attack by the Nipalese on the Frontier Thannahs of the 29th.

He had quitted my camp...in the afternoon on his way back to Lotun[9], but now galloped back with intelligence that he had fallen in with a party of 60 or 80 Nipalese in the Jungle beyond that village.

As he insisted on the truth of this, and the probability of it was increased by the reports which I had received for the last two days, that a body of 600 were expressly in pursuit of my Survey, I assembled my escort which only consisted of 20 Sepoys, and retired to the Camp of the detachment called in from Simmwaree, which was some miles nearer Goruckpoor.

I sent intelligence to the Military and Civil Authorities and while investigations were made into the particulars of the Thannahdar's report, the Survey entered Goruckpoor.

Camp Ekuman, June 5th. ... The Nepalese have not profited by our example in taking possession of the disputed lands. Instead of merely displacing the Tannahs, they have massacred them.

[1] Kosi R., 87° 5′ E. [2] B Pol C. 31–12–13 ; DDn. 129 (122). [3] Boorah Rapti, joins Rapti 63 M/4. [4] Palhi, now a *tahsil* in Nepāl, 63 M/10. [5] DDn. 131 (17). 20–1–14. [6] Fdbk. MRIO. M. 326 [7] Nichlaul, 63 M/11. [8] DDn. 136 (15), to SG. [9] 63 M/3.

Today we quitted Gorucpoor to resume the Survey where broken off by the Tannahdar's intelligence which, after our investigation, is granted to be undeserving of entire credit. The news of the destruction of the Tannah at Raikurrah has this moment reached me, and on my way to this place I find the road full of Burkandazes coming in from the advanced Tannahs.

While at Gorucpoor we have gained what may be regarded as an undoubted proof, of orders having been issued at Cathmando, to surprise my party before it had set foot in the disputed lands[1].

Resuming survey on June 6th, he closed it on the 8th in the city of Gorakhpur. War was now inevitable, but operations were postponed till after the rains, and Pickersgill carried on work [5]. On the 14th July he received orders from the Commander-in-Chief,

that a sketch should be prepared of the Frontier from Sheopoor on the Gunduck to Noutpoor on the Cosee[2].

In obedience to this order, I quitted Goruckpoor and arrived in Major Bradshaw's camp ...on or about the 28th of that month. After making preparations at a very considerables, expense, which included the purchase of elephants as the only carriage fit for the rainy season, this set in with such uncommon severity, that the whole country was flooded, and the rivers ...became entirely impassable from rapidity of current.

Actual survey having become utterly impossible, I had no other means...than what arose from the information of the Natives of the Turaiee[3] and of the mountains. This I collected with great labour and expence. I now enclose it as well as the Field Book of a Military Sketch.

In making this sketch, I...was under the necessity of reducing to half an inch to a mile. Even then the sketch embraced 12 sheets of large drawing paper, on which was delineated a frontier of 155 Horizontal miles, the west extremity of which rested on the Kotee river in the Goruckpoor Turaiee, and that to the east on the Baugmutty river[4]. ...

Colonel Kirkpatrick's itinerary [I, 75–6] was used as the authority for the roads into Nepal proper[5].

Military operations commenced in November with the advance of four separate columns; the first under Marley from Dinapore towards Kātmāndu; the second under Wood[6] from Benares through Gorakhpur to reoccupy the usurped lands of Butwāl and Sheorāj[7]; the third under Gillespie through the Dūn towards Garhwāl; whilst the fourth under Ochterlony advanced through Sirmūr.

Information was collected about all possible routes into Nepāl and the hills to the west. Crawford and Buchanan had both kept up interest in the country since the mission of 1802 [70], and were able to provide useful maps and reports[8] [72–3], whilst Hearsey, Moorcroft, and Rutherford [82] contributed descriptions of routes and passes collected by local agents and inhabitants[9] [90].

In his journey down the river Hodgson had met the Commander-in-Chief[10], and handed in a copy of his maps of the Dūn [84] with a description of the Gurkha frontier north of Sahāranpur. He writes to the Surveyor General;

On the River...Aug. 9th. ... On my arrival at Monghyr 4 days ago I was surprized to find...that I am directed by the Governor General to proceed up the Cossy River to endeavour to ascertain what route there may be from our frontier towards Katmandu. ...

My maps of the Doon Valley are considered as important & indeed are, for the possession of that Valley cuts off regular communication of large bodies of men from the Sutleez[11] Posts of the Gorkas to Nepal. ... I hope we shall get the Goorkas driven back across the Gogra & have a clear road to the Snowy Mountains in future.

Near Patna, Aug. 11th. I have had an opportunity of consulting your valuable map of Nepaul, also Col. Kirkpatrick's notices respecting the Cousy River within the Hills, which he says is reported navigable as far up as Delol Ghaut. ...

I have people in my Service, one is a Srinuggur Mountaineer[12], who I think will be prevailed on to go up the Coosy to Delal Ghat or Katmundu, and I will collect all the Information I

[1] DDn. 136 (65). [2] Nāthpur Arazi, 72 N/3; *Ben. Atlas*, iv. [3] *Tarai*; forest lands at foot of the hills. [4] Bāghmatī R. 85° 15′ E. [5] DDn. 147 (57), 1–11–14. [6] John Sullivan Wood. [7] MRIO. 31 (50), "Plan of the different routes of Major General J. S. Wood's Division of the Army, thro' the Gorakhpur Terai". [8] *Nepaul Papers* (37, etc.). [9] HMS. 644 (10), 21–7–14; DDn. 131 (89), 8–8–14; B Sec to CD. 27–12–14. [10] The GG., Lord Moira, had come out with office of C-in-C., and when touring up-country left Sir G. Nugent in Calcutta as Vice-President. Hastings' *Journal* (38). [11] Sutlej R. [12] from Garhwāl.

can from travelling Merchants, Brinjaries, Fakeers &c., and compare it with that of more substantial people.

Diggah, near Dinapour, Aug. 15th. ... In consequence of the satisfactory Information respecting the passes, &c. (received from you) [71–2], ... my Trip up to Cossy is countermanded, & as soon as the Maps & Memoir are finished for the Governor General I am to proceed to Calcutta. ...

Col. Fagan's[1] Zeal & Intelligence prompt him to offer every facility to our Department, & I am greatly obliged to him, & I am glad to find that my trips into the Doon be turned to so good account ; they would have been more replete with Military Information, but...I durst not be more particular in my Inquiries [82–3][2].

After reporting in Calcutta Hodgson was appointed surveyor to Marley's column, and returned to Dinapore with instruments, stores, and assistants, and three Maps for the use of the General Officer of the Dinapoor Division, viz. a topographical Map of the Valley of Nepaul [pl. 8], one of the Route from Sregauly[3] to Catmandoo, and one of that part of the Nepaulese Territories laying between our boundary and the Snow Mountains, and bounded on the East and West by the Teestah and Gunduck[4] [71].

He wrote Crawford on November 24th ;

I got up to the General's last Night, having run on ahead & delivered the Maps, which are highly prized. ... All is hurry, Bustle, and Confusion, & carriage most difficult to procure[5].

In the meantime Pickersgill had been appointed D.A.Q.M.G. ;

I am commanded to ascertain the principal routes and passes into Nepal. In prosecuting the enquiries...it was my good fortune to meet with an old man, formerly in the service of Pirthi Narain, the conqueror of Nepal, who had once travelled from the Turaiee to the valley by the course of the Baugmutty river[6] ; this report was supported by the evidence of a sepoy of the Champaran Light Infantry, who had accompanied Rau Bahadur in his flight from Lulit Patan to Benares by the same track about eleven years ago. ... I have now two native surveyors abroad[7].

In the course of his surveys and reconnaissance Pickersgill probably had as many encounters with the enemy as anyone with the eastern columns. He writes on Jan. 26th 1815. While taking these observations a spy on the part of the enemy was apprehended by my people. The smallness of my guard (2 Sowars and 8 Sepoys) making it inadvisable to expose the Survey to any risk, I returned to Camp. The total distance of today's movement has therefore been 29 m. 6½ f., which did not allow an interval of above one hour for rest between ½ past 7 in the morning and 12 p.m. midnight, at which time the Survey reached camp[8].

The following adventure has been described more than once ;

The interval between the departure of General Marley and his relief General Wood[9] was distinguished by an affair of some brilliancy, which tended in no inconsiderable degree to abate the presumptious confidence of the Goorkhas, and revive the exhausted hopes of the British force. [On Feb. 20th] Lieutenant Pickersgill, while reconnoitring, discovered at no great distance from the camp a party of the enemy about 500 strong. ... [He withdrew quietly to a favourable position and sent information to camp.]

The Goorkhas, encouraged by the small number of Lieutenant Pickersgill's force resolved to attack him ; but, on emerging from a hollow where they were posted, they perceived the force that was advancing to his assistance ; ... they made an immediated and precipitate retreat pursued by Lieutenant Pickersgill. ... The entire detachment was cut to pieces, and so great was the terror inspired by this encounter, that the Goorkhas hastily retreated into the hills, abandoning every position which they had established in the forest and Terai[10].

Hodgson and his assistants, Barton, Paton, and Edward Garstin left Dinapore on November 30th with Marley's division, and according to the following extracts from Hodgson's fieldbooks and letters had a less interesting time than Pickersgill. As is well known, the operations of both the Benares and Dinapore columns were conducted in spiritless fashion, and completely failed in their objects.

[1] the Adjutant General. [2] DDn. 136 (104–5, 107, 111–2). [3] Sagauli, 72 B/9 [43 n.1]. [4] DDn. 131 (109), 29–10–14 ; *Nepaul Papers* [224]. [5] MRIO. M. 575. [6] flowing south from Kātmāndu, II (21–2). [7] DDn. 147 (61), 1–11–14. [8] Fdbk. MRIO. M. 445. [9] Sir George Wood. [10] Thornton, IV (305–6); see also Hough, II (21–2) & Fraser (22).

Camp Lowtun, Dec. 30th. ... I meant indeed to have gone out for some days during this long Halt, but I can't go in front as the Forest 2 miles distant is occupied by the Enemy, & in the rear there is nothing of Interest to compensate for the probability of being left behind. ...

Barton desires his best regards ; the young men are now pretty good at taking the Latitudes, & I will find them plenty of Employment when we get elbow room. ...

Dec. 31st. Most of the month has been spent taking Astronomical observations for Longitude, etc.[1].

Bettiah[2], Jan. 23rd, 1815. [Various alarms and excursions ; lunar observations for Longitude]. ... This is a vile Campaign ; the Troops with the General can't stir either way. ... We can, I think, do nothing this year. ...

March 1st. During the first week of February there was heavy rain with storms of thunder and lightning, & the country was so laid under water that nothing could be done out of camp ; and afterwards the circumstances of the service were such that I could not with propriety go long distances to the rear to survey, nor could I go far in front with surveying apparatus, as the affair of the 20th[3] will show ; the enemy's posts being sometimes very near camp.

After the affair of the 20th, Capt. Barton & myself with some difficulty got sanction to proceed to Segauly [43 n.1, 70, 71], & I left Messrs. Garstin & Paton in camp to proceed with the Army[4]. ...

Traverse survey from March 1st to 28th. I was proceeding by this route to Jerickpour to join the General, but received information of his having returned...towards Baraghurry ; so I returned to that place, & joined the Army, & there received the General's permission to make a survey to Mateong & Segouly, & up the Sikrana towards Ramnaggur[5], that being the line on which the troops are expected to canton[6]. ...

Camp, Simourie. March 31st. I trust that you will make allowances for the Embarassments a Surveyor is placed in with an Army, for, however desirous I was to go out, that did not depend on myself, & it was not without difficulty I could get Sanction to be absent for a few days[7].

During April Hodgson carried on surveys along the frontier between the Gandak and Kosi rivers ; up to Rāmnagar, and to the highest point of the Sameswar range[8], returning to Bettiah early in May[9]. He writes from

Camp Ramnuggur, April 19th. The General with part of the Troops arrived here yesterday ; this is a shabby place, but a fine Country, full of Topes & Villages. ...

As soon as it clears up I will set up the Circle & get the Meridian, & I hope the Snowy Peaks [89]. I am anxious for Instructions from you ; in the Interim it seems to me best to make as long a Frontier Line as possible, i.e. from the Gogra to the Teesta ; so I mean to send off Barton to go to Junickpore[10], ... & then to go to the Coossy & cross it & go along the Frontier to the Teesta, all which I think may be done before the Rains ; young Garstin is on that side, and seems to have a very good Notion. ... He is not so well acquainted with the stars as Barton ; by the latter being there we shall be more assured of good Latitudes[11].

The campaign was brought to a standstill by the rains, and Hodgson withdrew, with his health badly shaken ;

I was taken seriously ill with the Jungle Fever & Ague, and as the fits came on in the evenings, & with great violence, I could not attend to the stars for Latitude ; but the weather also was thick & rainy. ...

I was taken to Mr. Glegg's house at Piperah[12], & there confined by sickness till late in the month [May] ; during the remainder of it I arranged & copied the map of the Bettiah Frontier, & sent it as ordered by the Commander in Chief to Headquarters[13].

In June he traversed to Muzaffarpur[14], and signed his field book on July 7th ;

The rains have been so heavy since my arrival that I have not been able to take any sort of observation[15], but am preparing to observe Latitudes & Longitudes by the moon's transits when the weather becomes clear[16].

An account of Ochterlony's advance through Sirmūr and the hills to the west, and the work of his surveyors, is given in another chapter [89–90]. After his final

[1] DDn. 136 (131, 139, 141). [2] 72 B/5. [3] Presumably Pickersgill's affair [41]. [4] Fdbk. Garstin & Paton, March 1815, MRIO. M. 544. [5] Sikrana R., 72 B/9 ; Ramnagar, 72 A/8. [6] Fdbk. M 446. [7] To SG., DDn. 136 (161). [8] 2887 ftg, 72 A/7. [9] Fdbk. MRIO. M. 446. [10] 72 F/14. [11] To SG., DDn. 136 (169–70). [12] Alexander Glegg., indigo factor; arrd. India 1788; Jaunpur 1807–12. Pipra, 10m. S. of Motihāri, 72 B/14. [13] *Nepal Frontier & Terrye between the Rivers Gunduk & Bogmutty*, with route to Patna, MRIO. 60 (24). [14] 72 F/8. [15] Fdbk. MRIO. M. 446 ; also M. 330. [16] Maps, MRIO. 61 (10), 62 (48), 89 (10).

success at Malaun in May, there followed protracted and unsuccessful negotiations with Kātmāndu over the draft treaty, by which the Gurkhas were to surrender the hill districts west of the Kāli, but take over most of the coveted *tarai*.

Military operations were resumed in February 1816. Ochterlony was given command of a force which advanced through Bettiah to Mukwānpur, and was successful in a few sharp encounters. When the Gurkha rulers saw that the threat to Kātmāndu was serious they accepted defeat and signed the treaty[1], which they have scrupulously and cheerfully observed ever since [1].

During this final advance Pickersgill again did valiant work in reconnaissance[2], and whilst George Lindesay surveyed the main line of advance[3] Paterson surveyed the route of the brigade on the right[4].

Lindesay says that he was employed on defence works during halts, and on survey during the advance; he recorded his paces and reduced the distances to allow for the winding of the track. "When paying a visit to the Goorkah Chief" his sepoys paced the distances, "while I was comparing my sketches, as well as I could without being observed, with what I had drawn in at a distance"[5].

[1]Treaty of Sagauli, 4–3–16 *Imp Gaz.* xix (35–8). [2]*Sketch of Nepal Valley from Sheomaisur Hill;* 6–11–15, MRIO. 89 (21). [3]Original sketches & panoramas, MRIO. 91 (26–7); BMC. 2–8–16 (147). [4]M 327 & M 447. [5]M 447.

CHAPTER IV

THE SOUTH-WESTERN MARCHES

Chota Nāgpur & Mirzāpur — Bundelkhand — Nāgpur — Mālwa & Rājputāna.

AFTER the work of Charles Ranken in 1781 [I, 38, 368] we find no surveys in the uplands of Chota Nāgpur before the various routes surveyed from 1801 onwards, mostly by officers of the Rāmgarh Battalion [I, pl. 14].

Between November 1801 and June 1802, William Cartwright surveyed a route of 689 miles from Hazāribāgh through Palāmau and Surguja and back to Chatra[1], whilst another officer surveyed the route of his battalion from Dinapore through Gaya, Singraula [I, 60 n.7] and Surguja to Burwa Nagar, or Jashpur[2].

When the Marātha War of 1803 led to the occupation of Sambalpur[3], it was Cartwright again who surveyed the route of the Rāmgarh Battalion from Hazāribāgh to Sambalpur and back between October 1803 and June 1804, but the surveyor who covered most ground was John Sealy [23] who, writes the Surveyor General in 1805,

was appointed Surveyor to Lieut. Colonel Broughton's Detachment in March last, having transmitted to this Office his Survey of the Routes of that Detachment between Ramgur & Sumbhilpoor, which are extremely satisfactory[4]. He is now desirous of resuming his Surveys in any other direction which Government should be pleased to order.

Lieutenant Sealy having at the same time suggested that a Survey from his present station, Hazareebaug, through Singboom and Chuta Nagpoor, skirting along the Western Frontier of Bengal, and along the Course of the Sunk and Bameny Rivers[5] to Cuttack [24], might easily be accomplished during the present dry Season. ... The Survey he recommends would be highly beneficial to Geography, inasmuch as the Country he proposes to traverse has mostly never been surveyed[6].

It was not every surveyor who won the Surveyor General's approval;

With respect to Lieutenant Menzies, I am very sorry that I cannot at present grant him a certificate for the following reasons; first, that his route was not kept agreably to the established form [I, 196], and that it is also very deficient in respect to the bearings of the road, and of towns and other objects which he passed; and secondly that, as he has entirely omitted the dates in the copy which he has sent, I cannot possibly specify the time he was employed[7].

Later on, a son of Charles Ranken followed his father's footsteps, and furnished a Survey of a Route through a Country hitherto very little known, viz. Patcoom and Tamar[8] etc., marched by the Ramgarh Battalion; it appears to be accurately laid down, and does Him credit[9].

In 1812 a body of *pindāris* from Rewah raided Mirzāpur and Shahābād, and aroused concern for the safety of the frontiers[10] [6, 47], and in reply to the Commander-in-Chief's request for maps the Surveyor General reported that,

after materially reflecting on the great want of information relative to the Geography of our Southern Frontier, and carefully searching all the records of our Surveyor General's Office, I am compelled to state that very little satisfactory intelligence is there to be obtained. This is the third time similar enquiries have been instituted, but when the causes which occasioned them had passed away, no further steps or notice were taken, and the requisite knowledge still remains a desideratum.

I therefore respectfully submit...the Propriety of having a correct Survey to be made of all our Southern Frontier, from the Mouth of the Balasore River, by Mohurbunge[11], Singboom, Gangpoor, Jashpoor, Sirgoojah...to Rotas Ghar[12], to include those parts of Midnapoor, Choota Nagpour and Palamow that are very imperfectly known.

[1] 72 D/16; MRIO. M 544. [2] ib. M 344. [3] Restored to the Rāja of Nāgpur, 1806. [4] MRIO. 60 (12, 14, 17); 63 (4, 28–48). [5] Sankh, 73 B; Brāhmini, 73 B to L. [6] DDn. 67 (411), 30–10–05. [7] ib. (461, 474), 20/5 and 20–6–06. [8] 73 E/12. [9] MRIO. 62 (42); DDn. 81 (95), 13–5–09. [10] Minto (59); Prinsep I (32); *Rewah State Gaz.* (17). [11] Mayurbhanj, 73 K. [12] From 73 K to 63 P.

This Survey should be made principally with a view to afford Topographical Knowledge to Officers employed in directing Military operations ; at the same time it will greatly assist Magistrates in establishing the Police, as well as the Collectors and Board of Revenue in the execution of their duties. ...

To render this Survey eminently useful, an able Officer should also be deputed not only to survey the Tract of Country, but for the express purpose of obtaining correct information and making accurate plans of all the Passes leading into the Territories of the Honorable Company. These drawings ought to be clearly descriptive, that when on the spot the Place should be known at the first glance of the views, and convey every information to enable the Officer commanding...to counteract and repel any attempt made against those Parts[1].

Charles Crawford [70] was accordingly appointed to survey Mirzāpur[2] and given a rough sketch of that part of the district, which has been only Surveyed in a very partial manner by Captain Browne when you was his Assistant.

This sketch was entitled "A Map of the Southern part of the Zemindary of Benares ; being a reduced copy of Captain Brown's Surveys"[3], and was probably by Thomas Crockat Brown, of Engineers, who had surveyed Benares city between 1784 and 1786 [I, 38, 315]. Crawford had served as engineer at the capture of Bijaigarh in the Kaimur Hills[4] in 1781 during the campaign against Chet Singh.

The Surveyor General continues ;

It is the wish of Government to have a very accurate Topographical Survey of the Borders of this Province, with a view to Military operations on the Frontiers ; to extend this work to... the Province of Bundelcund, and to have its Boundaries on the possessions of the Bugailcund, or Rewah, Rajah, carefully ascertained. ...

The upper parts of the Caraminassa[5] will also demand attention. It is almost sufficient to render it indispensable to be wet in crossing it, to prevent Hindoos from doing so, from the strong religious prejudice they have to the waters of this, by them named The accursed, River[6] (I, 24 n.7], which forms the Boundary of the valuable province of Shawabad[7] ; ... the back part of that district...is almost unknown to us, tho' it has been so long under our dominion.

Both banks of this River [Son], its Fords, and the places where it can be passed...will demand your particular attention, as will the little Pergunnahs called Chandail and Singrowla [44], known almost only by name[8].

With Hugh Morrieson as assistant, Crawford surveyed from Mirzāpur to Mau[9] in Bundelkhand during May, and then had to withdraw to Benares on account of ill health, resuming two months later. The Surveyor General then asked for a second surveyor to work eastwards along the south frontier of Chota Nāgpur ;

It is in the Deserts of Goundwannah [25 n.5], formerly a populous Country, but at present thinly inhabited, and in many parts nearly desolate, that Hordes of Pindaries meet and plan their Depredatory excursions, wherever they consider they may venture with impunity, ... and there are Hundreds of Passes leading into it with which we are little acquainted. I... recommend that some able officers should be directed to survey the whole Tract and make particular Plans of every pass, at the same time furnishing a topographical Description of each for record in this office[10].

Carmichael Smyth was thereupon appointed

to continue & extend the Survey of the Southern & North Western Frontier of the British Territories on which Lieut. Colonel Crawford is at present engaged, commencing from the North Western extremity of Palamou...and terminating...in the Province of Cuttack[11].

He was soon in trouble ;

Captain Smyth...is employed upon a very tedious as well as difficult Survey, as it leads him through intricate uninhabited & unhealthy tracts ; by latest advices from him, he had not advanced far on the Choota Nagpoor Borders, before the most part of his Servants, Guards, & Establishment, were thrown down in fevers, & as they were not able to move it was with the greatest difficulty he was enabled to get them transported to Chittra, on which he was obliged to fall back till they could recover[12].

Smyth's own account is worthy of record ;

January 22nd, 1813. ... It would be as well perhaps to begin the Survey at Hazareebaug, surveying thro' Palamow until I get upon the Boundy. near the village of Rankah[13]. ...

[1] DDn. 126 (143), 24–4–12. [2] Mirzāpur was then part of Benares District, but Wilford's survey of 1789–94 had not touched this southern area [I, 43–5, II, 35 n.11]. [3] DDn. 128 (86), 22–3–12. [4] 63 P/2. [5] Karamnasa R., 63 O. [6] "tainted" ; *Imp Gaz.* XV (21); Hastings' *Journal* (292). [7] Shahābād, 63 O/SE., P/NE. [8] DDn. 126 (138), 29–4–12. [9] 63 G/7. [10] DDn. 128 (115), 8–9–12. [11] BGO. 26–11–12. [12] DDn. 128 (143), 21–6–13. [13] to Garstin.

April 24th. I am very sorry to announce to you that I find myself, very much against my inclination, under the necessity of immedly. falling back from Choota Nagpoor on account of the dreadful sickness that prevails throughout my small party, the greater part of whom are down wh. raging fevers.

I yesterday sent in more men to Nowaghar, not able to crawl, in hopes of being enabled to get on, but since that more than twelve men have been attacked in the same violent manner, and the number increasing hourly. ... Only the total impracticability of carrying on the Survey ...wd. have induced me to stop at the present juncture.

My Havildar's Guard is reduced to four Sepahees, and I have not above two servants fit for any duty.

The Survey I commenced from Ibasaheea...I surveyed down to the Bank of the Kumin Rr. as far down as Bunga, which is the S.W. point of that District. The Boundy. is afterwards formed by difft. ranges of Mountains, and what I have accurately ascertained as far as this place, where the Sank Rr. divides Choota Nagpoor from Surgoojah. ...

On the other side I give you a statement of the poor fellows who are ill with raging fever ; it appears more like a pestilence than any fever I have yet seen. Four Sepahees, 2 Classies, and a Moolyee sent in to Nowaghur. Yesterday, Naik & Four Sepahees ; Two Kydmudghars ; Bheestie, Dobee ; Syce ; & Cook ; Five Bearers ; Two Classies ; Two Sumnahas ; wh. serious fever in Camp. And amongst these there is not one man but who must be carried in a litter.

July 10th. ... It will not be in my power to forward you any Field Book beyond the 24th of April, as after that period I commenced my retreat towards Chittra, more than three fourths of my people being in one sense completely hors de combat, and totally unfit for any kind of duty.

The whole of the Route from Hazareebaug, thro' Chittra to Gurwah, I have ready to send to your office, and...the rest of the Survey is in a state of great forwardness. Unless you particularly wish for it however, I am unwilling to trust its fate during this very inclement season to a conveyance so precarious & uncertain as the Dawk Bangy[1] [47, 221 n.5].

Smyth had completed the survey of a strip about 3 miles wide along the western frontier of Chota Nāgpur, or the present districts of Palamau and Ranchi[2], when in October 1813 he was called away to military duty, and Raper was appointed in his place.

The following notes are taken from Raper's fieldbook which covers the period from December 1813 to March 1814[3] ;

Feb. 9th. The whole of the march today was thro' the Mahratta Province of Gangpoor[4], there being no road near to the Boundary within the Nagpoor Frontier. ...

15th. Surveying along the Boundary between Nagpoor and Singboom[5]. ...

17th. The Koel River forms the boundary, till the line is continued to the North along the high range which skirts the left bank. This range divides Nagpoor to the East from the district of Gunga, a Mahratta Province...inhabited by a tribe of Banditti, who pay no revenue & subsist chiefly by plunder. They annually make incursions into Nagpoor, & lay waste the country & are such troublesome neighbours that the parts of Nagpoor bordering on the frontier are totally uninhabited. ...

March 15th. ... At this place information was received that the Zemindar to whom this pergannah belongs was determined to impede the progress of the survey, for which purpose he had assembled the inhabitants of the different villages, & had taken possession of the Ghats & strongholds with which this part of the country abounds, and which lay in the line of the frontier. ...

To proceed without his concurrence was impracticable, independent of the opposition which might have been expected, as neither supplies could be procured for the camp followers, nor guides to direct the route of the survey. After a delay of 5 days, the Zemindar, on receiving every assurance that his personal safety was not endangered, deputed an agent into Camp, & by his assistance guides were furnished, and the necessary arrangements made for the continuation of the survey.

Raper then suggested closing his survey over the Chota Nāgpur plateau to fill up blanks within the Company's territories, and, Roughsedge, the political officer, agreed ;

I...entirely concur with you in thinking that so favourable an opportunity for gaining a better knowledge of the central parts of Chota Nagpore should by no means be neglected ;

[1] to Crawford DDn. 130 (1, 13, 29); map, MRIO. 63 (17). [2] B Pol C. 23–12–15 (24 maps, MRIO. 60 (2–10), scale 2000 yds. to an inch). BSC. 15–10–13 (16) ; BGO. 26–11–13. [3] MRIO. M 240. [4] 73 B, south. [5] 73 F.

I am the more desirous of this, because I could not without Inconvenience augment your Guard at the present Moment, ... for you to explore with Safety the extensive & hitherto untravelled Pergunnah of Koonjee.[1] ...

On the supposition that you are now near Patcoom[2], I beg to suggest the following Zigzags into Chota Nagpore ; ... thence to the South Eastern Extremity of Patcoom, after which, should there be time, you may conclude the labour of this season by tracing the boundary of Burraboom[3]. The Pergunnahs which the Trips I have described will enable you to lay down are either Blanks, or incorrectly placed in the Maps [I, pl. 14].

After the Rainy Season you can continue your Survey of the Coonjee & other districts, which I think will require three or four months for completing[4].

Three years later Roughsedge asked for fresh maps to replace those he had furnished to Lieutenant Robert Smith [*inf*]...and which were spoiled in the Dawk Bangy last rains when that officer returned them to me. ... Captain Raper who surveyed the South West and Southern Frontier of Chota Nagpoor, was kind enough to prepare for me a map of the boundary, which has already more than once been of use in settling disputes, and, if allowed to me, the labors of Captain Smyth, etc., will also prove acceptable[5].

Besides these regular deliberate surveys, further routes of the Rāmgarh Battalion were surveyed during 1812 and 1813 by Roughsedge, Rogers, Ferguson, and others[6].

To return to Mirzāpur, Crawford continued his survey of the Son and the country between Mau and Rohtās until the middle of March 1813[7], when on relief by Robert Smith he went down to the Presidency to become Surveyor General [295]. Smith continued survey till the end of May 1814, and produced a magnificent map of the whole district, with large scale plans of Rohtāsgarh and other forts[8]. He writes from Hazāribāgh on July 3rd 1813, at the end of his first season ;

I have gone over an immense Tract of Ground & altogether under Circumstances in many Respects very unfavorable—the Extreme Heat of the Season (the Thermometer in our Tents being scarcely ever less than 105°, running generally to 108°, & now & then 112°)—The long marches necessary to keep with the Detachment & latterly—the difficult & unfrequented Route by which I passed.

These reasons, added to the ill prepared State in the way of Instruments in which I left Dinapore, have given me no opportunity of making such astronomical observations as I would have wished. The most [particular] attention has been paid to accuracy of Survey as well as to obtaining such information & materials as I hope will give a full & accurate Insight into the [nature] & Geography of the Country on the right & left of my Route.

Mr. Hutchinson [90] has been with me throughout & proves himself a very [useful] assistant[9].

At the end of 1813 a force was sent into Rewah, or Baghelkhand, to ensure the safety of the frontier against *pindāri* raids, and George Lindesay surveyed the routes from Mirzāpur to Rewah, and with the help of local information made a useful map of a large part of the State[10].

BUNDELKHAND

Bundelkhand, home of the Bundelas, lies south of the Jumna, bounded by Mirzāpur on the east and the Chambal River on the west, and extending southwards to the territories of Nāgpur[11]. Most of the Bundela *thākurs*, or petty chiefs, were at this time under the domination of the Marāthas. One of the first moves of the British on the outbreak of the Marātha War in 1803 was to occupy Bundelkhand, and at the close of the war the districts lying along the Jumna were retained in the Company's possession[12] [1].

[1] Khunti (?) 73 E/8. [2] SW. corner of Ranchi District, 73 E/12 ; *Ben Atlas*, vi. [3] Barabhum, 73 I/4. [4] DDn. 131 (40), 26–3–14 Raper's maps cover route from Rāmgarh, via Lohardaga to the Sankh R., along the S. frontier of Ranchi District as far as the Subarnarekha R., and thence back to Rāmgarh ; MRIO. 41 (27–40). [5] DDn. 142 (141), 9–8–17. [6] MRIO. M 542. [7] Map of S. Frontier, Crawford, MRIO. 18 (2) ; see also 81 (48). [8] Fdbks. & Memoir, MRIO. M 339, 378 ; Maps, MRIO. 16 (50), 60 (23), 97 (12). [9] DDn. 130 (47) 3–7–13. [10] DDn. 270 (36) ; Fdbk. MRIO. M 376 ; maps, MRIO. 82 (31–3) ; 83 (23) ; 84 (39, 40) scale 3½ m. to an inch. [11] Historical account, Pogson. [12] The upper *doāb* [6, 28] and the present districts, Jalaun, Jhānsi, Hamirpur, and Bānda, south of the Jumna, formed the *Conquered Provinces*.

The Surveyor General could produce no maps to assist the troops ;

There is not in this Office any Map of Bundlecund, as it is a Country which had until lately been unexplored by Europeans, and of which our Geographical knowledge is extremely limited ; I have not had it in my power to commence on the Construction of any new Map of that Province.

The Communication of any routes or materials which might have been obtained by the Officers who have, since the commencement of the War, been on service in Bundlecund, would greatly have facilitated such an undertaking, but of these I am sorry to say that I have not received one, ... which circumstance I request you will report to Colonel Martindale[1].

He pressed for Government action,

suggesting that it would be desirable to have Surveys taken of the newly acquired Countries in Hindoostan, and to the Westward of Orissa. ...

Among the few Officers possessing sufficient qualifications in that Line, and whose opportunities might, if encouraged, enable them to perform Surveys of parts of the Country hitherto but imperfectly known, I beg leave to mention Lieutenant Frederick Sackville, now serving with the Detachment in Bundlecund, ... having communicated to me a Route of the March of Lt Colonel Martindale's Detachment from Kalpy[2].

Sackville had been assistant surveyor to Martindell's force since September 1804, and was now appointed Surveyor under the professional orders of the Surveyor General, who asked him

to survey the Eastern rather than the Western part of Bundelcund, the former being least known, and we are even in the dark with respect to the true position of Banda where the Commissioners reside. ... The most valuable acquisition in Geography that can now be made to the West of the Jumna will be a map of the Country lying between the Western Boundary of the Allahabad District (south of the Jumna) and Kalinger, Chatterpour, Dutteh, Jhansi...and Kalpy. The only measured Lines which have been procured throughout all this Track have been Coll. Goddard's March from Kalpy [I, 38–9]; ... Lieutt. Anburey's & Blunt's Survey when returning from the Duckun in 1792 [I, 43]. ... The rest is all a Blank, or nearly so, in my Map[3].

Whilst you are encamped at Jhansy during the Rains, I apprehend that little can be done for Geography, but if you could procure for me a few good Harcara Routes, with stages at short intervals, and mentioning the Rivers and Nullahs to be crossed, they would prove very useful for filling up some Blanks in my General Map[4].

I was very sorry to learn that you had been indisposed with a fever.

I was glad to find by your last letter that you were preparing to set out on a new excursion from Jansey. The Track you have pointed out will be useful, though I could have wished it had been less over the beaten Tracks of our Troops during the late campaigns, ... but the country between Koonch[5] in a northerly direction to the Jumna at the Embouchures of the Chumbul and Sind[6], is yet unexplored, as well as the roads which lead from Banda direct to Allahabad ; these two routes, if well surveyed, would enable us to fix the position of Banda in the most satisfactory manner, as well as to fill up some blanks. ...

A few bearings of the Hill Fort of Kalinjer are likewise much wanted. A route from Jansy to Chatterpoor[7], if it could have been surveyed, would have been very desirable indeed ; but if Colonel Martindale, your immediate Commanding Officer, has no power to separate you from the Detachment, much less can I attempt to do so[8].

The following year the Surveyor General suggested that Sackville should work entirely under civil control ;

Of the several Surveyors who were employed last year, only one now remains in employ, viz., Lieutenant Frederick Sackville, Surveyor with the Bundelcund Detachment ; but as in consequence of his remaining with the Troops under the command of Lt Coll. Martindale, he has not had the free use of his time, and his Operations have hitherto been much cramped, I would beg leave to propose that he be removed from the Detachment, ... and directed to join the Commissioner at Banda, under whose Orders, aided by the Instruments that I should occasionally send him, he could Survey all that remains of the unexplored Parts of Bundelcund, as might be found practicable[9].

This proposal was sanctioned and Colebrooke wrote to Sackville ;

[1] DDn. 67 (349); letter to Ens. James Hyde, Engrs. 5–12–04. [2] MRIO. 31 (68); 81 (15, 16, 20, 21); DDn. 67 (367), 12–3–05. [3] MRIO. 31 (51–65); 81 (43–5, 57–67); 83 (26–9, 34–8) DDn. 79, 10–4–05. [4] DDn. 67 (389), 10–8–05. [5] Kunch, 54 O/1. [6] Both join Jumna in 54 M/2 & 3. [7] 54 P/9. [8] DDn. 79, Letters from SG. to Sackville, March to Oct. 1805 ; also journal of a column commander in Bundelkhand July 1803 to June 1805. [9] ib. (428), 12–3–06.

You will now have it in your power, I trust, to survey all the remaining Parts of Bundelcund with which we are hitherto unacquainted. ... A few good observations for the Latitude are much wanted, ... and I trust that you will eer long be able to make them.

It is very desirable that you should include Chatterpoor in your Survey, which I understand is *now* in our Possession, and if practicable a Route from thence to Chanderee[1]...(a very large City lying about W. ½ S.—96 Miles from Chatterpoor—belonging to the Peshwa[2]), would be a very valuable addition to your Map. ...

From Banda you could survey the high road to Allahabad. From the latter station a route in a South direction would enable you to fix the positions of...places which belong to us, and of some consequence, but which are not included in Major Rennell's Maps ; you could then return to Banda by a different road, or proceed direct to Kallinger, should that Fort by that time be in our possession[3].

The country remained in a disturbed condition for many years yet, and Sackville had many adventures. In April 1806, with escort of a company, he went to ascertain & lay down the confluence of the Chumbul, Sinde, and Pohoodge Rivers[4] with the Jumna. Great difficulties and obstacles were opposed to this survey, in consequence of the jealousy and barbarism of the feudal tribes inhabiting the banks of the Chumbul & Sinde rivers ; the company was ultimately threatened with attacks from parties of irregular troops ; it was fired upon by the forts with which this country is covered, and experienced every opposition to the obtaining of supplies.

In June 1806...returned to Bandah...for the rainy season, having succeeded in his mission. ...

In March 1807, ... proceeded, with a small detachment of 30 men, to penetrate and reconnoitre the country on the Boghela[5] Frontier, and to bring into his survey the Soane river ; he found every place in arms at his approach, and was pursued by a large collected force for a considerable distance.

In order to save his party, Lieutenant Sackville galloped singly into the midst of them, at the moment they were aiming their pieces to fire, took them by surprise, and succeeded in gaining protection and supplies for the night. Similar proceedings occurred on the following night ; ... the Rebel Gopal Singh [51] was...in pursuit of the little party. Lieutenant Sackville marched immediately towards the Headquarters, 60 miles distant, passed the night within hearing of the enemy, and arrived safely in camp on the following day[6].

Sackville had completed all accessible parts of Bundelkhand early in 1809, and was then called down to Cuttack [24], the Surveyor General reporting that he had transmitted the last Field Book. This Officer is proceeding to Cuttack, and may shortly be expected at the Presidency ; he is at present usefully employed in making a fair Copy of all his labours ; from the drawings produced by him, I am led to think that Bundlecund has been more accurately surveyed than any other Province under this Government[7]. ...

Lieutenant Sackville is arrived in Calcutta ; it will require the whole of the Rainy Season to complete His Map[8], and render it as perfect as possible, as well as to mark in several Portions of Land that have been assigned to various Persons by order of Government, as particularly required by the Court of Directors[9].

His surveys were later extended by William Morrieson ;

Some small additions have been made to the Geography of the Province of Bundlecund by Ensign Morrieson, who was attached as Surveyor to Lieutenant Colonel Martindale's Detachment. ... His labours were greatly impeded by the number of Pindaries [6, 44] who occupied the country near the Army, and the Officer Commanding did not judge it prudent that Mr. Morrieson should go beyond His outposts[10].

Amongst the operations undertaken by Martindell was an expedition made between January and March 1810 "to expel the Marauder Gopaul Singh from the Province of Bundelkhand "[11], and to co-operate with Madras troops under Barry Close[12] to dislodge another gang under Mir Khān from Sironj [86, 134]. Morrieson's survey was carried from Chhatarpur to the neighbourhood of Sironj, not far from Close's camp, and back to Chhatarpur. The following extracts are taken from his letters and fieldbooks ;

[1] 54 L/2. [2] The Marātha ruler at Poona. [3] Kālinjar Fort was not captured till 1812. DDn. 67 (527), 30–4–06. [4] Pahūj R., rises near Datia, 54 K/6. [5] Baghelkhand, or Rewah [47]. [6] *EIMC.* I (372 *et seq.*). [7] DDn. 81 (95), 13–5–09. [8] 4 m. to an inch 83 (18–20); 6 miles to an inch ; MRIO. 15 (15). [9] DDn. 81 (128), 15–6–09. [10] From SG., DDn. 126 (3), 24–3–10. [11] B Pol C. 2–1–10 (12). [12] Resdt. Mysore, 1799–1801 ; Resdt. Poona 1801–11; M Gen. ; Bart.; d. 18–4–13 [91].

Route of Col. Martindell's Detachment from Chatterpoor to Keitah in Bundelcund, from Jan. 12th to May 20th 1810[1]. ... Camp Dureeah. ... Jan. 29th. ... During my stay at Chatterpoor I was as fully employed as I have been since, in renewing the Map of Bundlecund for Colonel Martindell which was in a very shattered state. ...

Report says that Meer Khan is on this side of Sironje, within four days easy march of us, and that we are now waiting for orders from Colonel Close[2]. ...

Feb. 11th. The D.Q.M.G. [Blacker] with 4 assistant Surveyors arrived in Camp from the Madras Army [134], which has arrived at Seronge[3]. By order of Col. Martindell I furnished them with a rough copy of my route upon condition of having theirs sent in return[4]. ...

13th. The Madras Government have long paid particular [attention] to this Branch, and spare no expense towards procuring the best possible Routes and Information.

I make these observations that there may be some excuse for my Route when they come to be compared. Although I have not seen theirs, I conceive it must be Infinitely superior to mine, the whole being Superintended by the Quartermaster General, who has four Instructed Junior Officers under him[5], with a large establishment of Guides, Harkaras, and people who have long been accustomed and taught the business, besides being furnished with every assistance from the Commanding Officer, whereas, on the contrary, I have none of these advantages to boast of. Another thing which adds considerably to my disadvantage is the want of those Instruments which are so necessary, and which are so liberally furnished by the Madras Government.

After leaving Deeneeah, ... we marched in a Westerly direction to a place called Bharda, near Rampoor, 12 miles, at which place the Madras Army was encamped. The day before yesterday, the D.Q.M.G. with his four Assistants arrived in our Camp, and took a copy of our Route. This morning we marched back again[6]. ...

14th. Wrote to the Surveyor General informing of my having given a copy of my route to the Madras Surveyors. ...

Took the following observations for a latitude, but fear little dependance can be placed upon the accuracy, from the variation of the error of my sextant. ...

15th, 16th, 17th. Employed protracting from my field book & made daily applications for leave to survey in the neighbourhood, but without effect.

18th. Doubts being entertained respecting the correctness of my distance...to camp, having tried my perambulator, set out [to re-measure]. ...

27th. A detachment of 5 companies being ordered out, I applied for leave to accompany it, as the country, in whatever direction the detachment might take, was equally unknown, ...

March 2nd. To my old spot near the Bungalows of Chatterpore Cantonments. Here we were obliged to halt the 3rd March.

4th. Left Chatterpore Cantonments to Mow[7].

March 14th. Jhansi. ... Since my return from Chatterpour, ... laid up with the effects of the Sun, which now begins to get very warm, and to which I was unavoidably exposed during our long marches there. ...

I have the pleasure of announcing the arrival of the Madras Route ; it is however a new Route, Major Blacker making press of time his excuse for not sending Field Book with it[8].

March 23rd. Keitah Cantonments. Halted there the 24th, and attempted an observation with my old sextant, which however I cannot depend upon. The latitude I made was 25° 28′ 45″. The cantonment here lies about a mile to the North of the small village Keitah. ...

April 8th to 30th. ... From the 8th to the 12th employed protracting the unfinished part of this survey. From the 12th to the 30th April employed in making a general map from all my field books upon the scale 6 miles to an inch, and joining it to the Soane, which it does very well. ...

May 16th Mau. Here I found the detachment on the evening of the 18th. The different corps marched off to their destinations. I returned to Keitah by a new route to trace the course of the Lakery & check the situation of Torreefutteepour[9].

17th. At Torreefutteepour. The Rajah here is a relation of the Theree man. Experienced the greatest insolence from his seepoys, who appeared very jealous of my observations.

20th. Keitah Cantonments. Here I found orders to proceed to Benares, and left Keitah on the morning of the 21st[10].

The Surveyor General writes later that Morrieson,

[1] This survey described elsewhere as *Route of the Bengal Army from Srinuggur to Keta*; DDn. 128 (16), 12–4–11. Kaitha, 14 m. NW. of Charkhāri, 54 O/10. Site of old cantonments marked on map of 1935. [2] to SG. DDn. 82 (129). [3] 54 H/12. [4] Fdbk. MRIO. M. 334. [5] probably Burnett, Jourdan, Hanson, & O'Donnoghue [166]. [6] To SG. DDn. 82 (126–8). [7] Mow, 30 m. E. of Gwalior, 54 J/11 ; not same as on p. 45 n. 9. Fdbk. MRIO. M. 334. [8] To SG. DDn. 82 (135). [9] Tori Fatehpur, 54 O/3 ; mentioned by Anburey in 1793 [I, 43]. [10] MRIO. M. 344.

who penetrated into the further parts of Bundlecund, has sent in some useful information concerning those districts not visited by Lieutenant Sackville, which will render the Survey of that Province, as far as our knowledge extends, very complete ; His drawings do Him great credit[1].

At the end of 1811 Government sanctioned a survey of the western frontier along the Chambal, after obtaining the acquiescence of Dowlat Rao Sindhia. The Surveyor General had reported that

Lieutenant Sackville's survey includes only a small space of about Ten or Twelve Miles upon its Banks, where it falls into the Jumna, which is hardly worth noticing, and in none of the other Maps is this stream even tolerably well laid down. According to the best authority, which however is very dubious, the Chumbul takes its rise near Peplowda[2] in the Malwa Country, and forms the Northern Frontier of Ghod[3]. ... It is certain that an accurate Map of its course would be very useful in case of a War, and most probably to the Civil Magistrate in time of peace[4].

The survey was carried out by James Tod in 1813,

along the Chumbul River, forming the British Frontier and that of their Ally, Khanah Keerut Singh, from the Kerowly demarcation to the Junction of that river with the Jumna, and along the latter stream to Kalpee[5].

Bundelkhand remained the scene of disorder and trouble for several years yet, and whilst British columns were continually pushing south and west to protect the frontiers Cornet James Franklin extended the survey and added to Sackville's map. His first surveys were of the routes of Lt Colonel Brown's detachment which spent from May to December 1811 in pursuit of Gopāl Sĭngh [49], and in forwarding his map Brown comments that :

The tract of Country which the accompanying map delineates was so imperfectly known when I passed over it that it was seldom I could find a known place near enough to point out in my public despatches the position of my camp. It is the constant haunt of marauders and the disaffected of the frontier, and a knowledge of its Geography and localities is absolutely required to put us on an equality in carrying on active operations for their suppression.

No officer would be found better acquainted with the features of the country, or better qualified in point of language and general acquaintance with the Native Chiefs, than Mr. Franklin, and I may safely affirm also that in the Scientific part of the profession few would prove his superior[6].

Franklin himself writes that he

had no other aid in arranging the enclosed sketch than a small pocket compass and a case of mathematical instruments, and our marches being unusually long, and chiefly by night, I am persuaded...that accuracy such as you require is not to be expected from it. My assiduity indeed was increased in proportion to my want of aid, and much local information was accordingly obtained, very useful for military purposes, but I consider it in no other light, and have therefore termed it a sketch.

I have moreover refrained from embellishment in the execution, under a conviction that your known penetration would not be deceived by appearances, and I hope you will not measure my capacity for completing an efficient Survey by the hasty and imperfect production herewith transmitted[7].

At the end of 1813 the Commander-in-Chief asked that Franklin might be formally appointed to survey "the Southern Frontier of Bundlecund" ;

Lieutenant Sackville's map of Bundlecund does not include its Southern boundary, nor any of the great routes and passes leading into the province from Malwah, and there are besides considerable blank spaces...in Lieutenant Sackville's map, which circumstances did not admit of being rendered so extensive and perfect as it might now be made[8].

In sanctioning the appointment Government ordered that "Cornet Franklin should be cautioned not to attract particular notice in the performance of the duty", and the Political Agent advised him to extend his Surveys

into the Territories of those Chiefs not immediately dependant on us, such as the Berar Rajah or other Mahratta States. ... Your most adviseable course of proceeding...would be to obtain

[1] DDn. 128 (11), 12–4–11. [2] Piplauda, 46 M/7. [3] Gohad, 54 J, surveyed by W. N. Cameron in 1780 [I, 40]. [4] DDn. 128 (49), 10–11–11. [5] MRIO. 33 (31, 32). [6] DDn. 130 (53), 6–8–13 ; Journal, May to Nov. 1811, DDn. 162 (2). [7] ib. (57), 6–8–13 ; maps, MRIO. 81 (8–10). [8] BMC. 16–10–13 (34).

correctly the boundary of our immediate Frontier, and the Ranges of Hills, noticing particularly the different passes which they contain, and leaving the Southern boundary of the Jagiers, that is their line of Frontier with the Mahratta Country, to a future opportunity.

Passing this to the Surveyor General, Franklin comments ;

The examination of the passes will retard me much, but I hope nevertheless to convince you that idleness or negligence forms no part of my character, as I am by this time fully assured that they ought not to encumber a Surveyor[1]. ...

The Tract of Country I have already surveyed comprises about 30 B. miles of Lat. and 46 of Longitude, and includes...the passes, of which I have marked with care and examined all such as are of any notoriety.

I also pass over every yard of the boundary, and mark it with particular care and attention, and make a point also of protracting and proving my day's work before I rise from my table, and never defer the business of one day to another. ...

The country above the hills for a short distance is almost an impenetrable Jungle, compared with which the country below is absolutely a paradise[2].

He continued survey through 1814 to March 1815, and his maps[3] proved invaluable in the subsequent campaigns against the *pindāris*.

NĀGPUR

Knowledge of the central regions of India had been largely obtained through journeys of political missions, from the directions of Orissa, Chota Nāgpur, Bihār, and further west, [I, 39, 42, etc.]. The Nāgpur Rājas[4] had always been on friendly terms with the British until the Marātha Confederacy of 1803 [57], after which they had to accept a British Resident at Nāgpur, the first being Mountstuart Elphinstone [65–6].

The Resident's escort of two companies, left Hazāribāgh on February 25th 1806, under the command of William Lloyd, who kept a survey of the route, through "Coondra, Sumbulpore, Saumgur, Ruttunpoor, Khyragur, and the Laujee Ghaut"[5].

In submitting this to Government Elphinstone proposed the extension of surveys through the Nāgpur dominions ;

On my arrival at this place...I was naturally desirous of obtaining information regarding the Geography of this country, at present so little known. I was however for a long time deterred by the fear of exciting the Raja's suspicions by any attempt to explore his Territories.

Having lately discovered that Geographical enquiries might be easily conducted so as to give no offence, I have for these months employed some Hircarrahs to collect information regarding the parts of the country which are worst filled up in the Maps. The result was such as to satisfy me that the latest Maps are not only deficient but incorrect in some of the leading features of the countries laid down. ...

It is unnecessary to give any instances of the deficiences of the best Map of the Boosla's dominions, as they are evident from mere inspection. The only method of remedying this inconvenience is by means of enquiries carried on at Nagpore. I should think it my duty to attend to the subject myself, but my official business would prevent my giving sufficient time to it, even if I were otherwise qualified.

It appears to me that, in the attainment of this desirable object, particular advantage might be derived from the employment of Lieutenant Lloyd, with whose military duty it would not interfere.

Government warmly approved, and sactioned "a small increase in the number of Hircaras maintained, for this purpose"[6].

At the end of 1806 another route to Nāgpur was surveyed by Henry Roberts commanding the escort of Richard Jenkins who was proceeding to relieve Elphinstone. In sending instructions for this survey the Surveyor General wrote ;

Any Route by which Mr. Jenkins could proceed to Nagpoor, might, if properly surveyed, prove beneficial to Geography. As the road by which he is to proceed, ... from Mirzapoor,

[1] DDn. 130 (141), 15–1–14. [2] ib. (171), 3–3–14. [3] MRIO. 83 (30–2); 96 (13). [4] also termed Bhusla Rājas, or Rājas of Berār [23]. [5] B Pol C. 23–10–06 (7A). Fdbks. MRIO. M 222, 227 ; Maps, ib. 73 (1–12). [6] B Pol C. 8–1–07 (89–91).

through Gurra-Mundilla[1] [I, 29], has been repeatedly travelled by our Embassies with their Escorts, and has been twice, though but imperfectly, surveyed, little benefit can be expected to result from Lieutenant Roberts' proposed Survey unless he be careful to rectify the omissions of former Surveyors, or should have it in his power to deviate...from the beaten track[2].

He pointed out various diversions that would provide new information, but, as it happened, Roberts's survey started from Hazāribāgh[3], and coincided in some parts with Lloyd's; he returned by the same route four months later, the Surveyor General commenting that his fieldbook had been exceedingly well kept"[4].

During Lloyd's long stay at Nāgpur, which continued till 1820, he collected a vast amount of geographical knowledge, mostly from routes measured by himself or by his *harkaras* [5, 353–4], of whom two named Mahadeo and Kistna appear most frequently[5]. He was most industrious also in putting together maps that proved their value during later operations against the *pindāris*. His work was encouraged and greatly appreciated by the Surveyor General;

I have...recommended...you an increase of allowance; I hope it will be attended with the desired effect. One thing is certain, your labours will benefit yourself, for no officer can employ His time to better purpose. Surveying makes him a judge of Ground and of distances; it promotes Science, and gives reputation, and is far preferable to being idle. The recommendation of your labours is recorded, sent Home, and will be useful at a time when you do not expect it; at any rate it can do no harm[6].

I have further to request of you to fill up such blanks as may remain with all your latter Routes, accompanied with every other information that may afford a better knowledge of a part of Country which has hitherto been but imperfectly (and in some parts not at all) surveyed; particularly East of Nagpoor, towards the Province of Cuttack[7].

Lloyd's surveys[8] were not of a high order of accuracy, but he took constant observations for latitude to tie them together;

My time is employed in bringing into one point of view in the form of a Map, all the Surveys made by my Hircarrahs; but in this work I am a good deal perplexed, as some of the positions have been fixed by Astronomical Observations, and from the imperfection of the Instruments used in these Surveys (a common pocket compass and Perambulator), they of course cannot be expected to be very exact. ...

Most of the great Roads have been measured excepting those South of Nagpoor. ... If any *particular work* is required from me, my utmost endeavours shall be exerted to merit your approbation[9].

In 1814, Blacker, Quartermaster General at Madras, suggested that James Bayley, who was at that time in Bengal, should survey a line from Allahābād through Rewah to Nāgpur;

The operations of the Troops under the Command of Colonel Close on the Nurbudda in 1809 and 1810 [133–4] afforded the means of Connecting the Geography of the Bengal Presidency on the Bundlecund side with that of Madras on the side of Berar. It remains however still a Desideratum to have a Military and Topographical Memoir of the Country between Nagpore and Benares. ...

Lieutenant Bayley of the Quarter Master General's Office is at present in the Upper Provinces of Bengal on duty with Major General Gillespie [135–6], and will be shortly on his return to the Coast. He possesses all the requisite qualifications for collecting the desired information[10].

The Resident at Nāgpur pointed out that

Lieutenant Bayley's operations would be liable to frequent interruptions from the Pindaries, and it would be necessary for him to have such a guard...of at least thirty firelocks, and it would be necessary that he should have a passport from this Government. The Rajah does not object to grant passports for the Hirkarahs sent by Captain Lloyd with the perambulator to Survey any part of His Highnesses territories, and...would, I fancy, grant a passport for Lieutenant Bayley.

The tract in question has been traversed and Surveyed in various directions by the Hircarrahs of Captain Lloyd. ... It might be considered whether the Ends proposed...might not be answered by allowing Lieutenant Bayley to copy parts of Captain Lloyd's Survey as relate to the tract[11].

[1] Mandla, 64 B/6. [2] DDn. 81 (38), 21–11–06. [3] 27–11–06. [4] DDn. 126 (22–3), 17–5–10.
[5] MRIO. 71 (8, 39, 55, etc.); 72 (30, etc.). [6] DDn. 81 (104), 15–5–09. [7] ib. 126 (104), 26–9–11.
[8] Fdbk. MRIO. M 222–5; Maps, ib. 71 (2–44), 72 (2–66), 73 (23–30). [9] DDn. 130 (9), 10–5–13.
[10] MMC. 28–6–14. [11] B Pol C. 27–9–14 (49).

Bayley carried out this survey during November 1814, and rejoined his Madras duties at Jālna in Berār.

MĀLWA & RĀJPUTĀNA

An important line in quite a new direction, from Gujarāt through Mālwa to northern Rājputāna, was surveyed by Sealy and Byers of the Bombay Infantry, who accompanied a division of the Bombay Army[1] operating with Colonel Monson against Holkar in 1804–5 [57]. The following notes are taken from their journals and fieldbooks[2] ;

The march lay from "Capparwanji to Dhond, and then through Dhaude[3], a Town on the confines of Malwa and Guzerat belonging to Scindia" to reach the Anās River[4] on 24th June 1804. Crossing the Chambal they reached Ujjain[5] on July 8th ;

The road to the City is by a gentle descent, the Country quite open, & the scene in front highly interesting. Some thousands of the inhabitants, prompted by curiosity, came out of the Town to Witness the arrival of the Army, a Sight apparently novel to them, for a more astonished multitude were never seen.

They halted for the rains near Ujjain till October 19th, when they started occasional skirmishes with enemy cavalry. Marching northwards in February 1805, they reached the headquarter camp before Bharatpur on April 1st, after the siege had been abandoned[6] [57]. Marching from Bharatpur on April 21st they moved to Dholpur[7], and eventually cantoned for the monsoon at Tonk, on the Banās[8], "and have found it a dry healthy situation". They marched northward to Jaipur in October 1805 ;

Jeyepore. ... None of the Troops or followers of our Army are permitted to enter the Town, & the inhabitants seem notorious for their insolence and aversion to Europeans. It is the first Commercial & manufacturing Town in Hindoostan, and is visited by Caravans from every part of Asia.

The most northerly point reached was Nārnaul[9], which

appears formerly to have been a magnificent Town, from the numerous remaining edifices. It is now sadly in ruins. ... Holkar retreated from the place only on our advancing from Jyepore. ... It is an open town and formerly belonged to the celebrated George Thomas [57–8], & is several miles further North than laid down by Major Rennell.

On the return journey to Baroda[10], the army reached Tonk on December 4th, and the surveyors conclude their journal ;

It seems necessary that an Explanatory Memorandum should accompany the Field Book and Sketch, in order to account for some deficiences in point of information which occasionally occur. ...

We were expected to march with our Companies, indeed never could quit them without laying ourselves open to reprimand, which prevented our getting the names of many Villages the Army past, whose situation we have otherwise remarked ; besides the great quantity of dust risen by the men and baggage generally prevented our making any observations on the reverse flank, and even at times prevented our seeing any objects in that quarter, and we often found it a Serious impediment to our remarks on the Pivot flank.

The Army, until it reached Rutlam[11] on its return, invariably marched in two Columns, baggage in the Centre, the Right wing (to which we were attached) generally being on the Right. In this order of March, it is evident, only one of the Columns could be on the high road, which most frequently fell to our lot. The road given by us is that followed by our Column, and which may occasionally deviate a mile or so from the high road ; consequently the Villages given by us are not to be invariably considered as standing on it.

The Country was in general so level as to admit the Army going direct to its destination without any regard whatever to the roads.

Besides the roads noticed in the Field Book, there are others laid down in the Sketch... which have been followed by such Detachments or Foraging Parties as neither of us have

[1] commanded by Col. Murray. [2] B Pol C. 11–7–08 (48). [3] Dohad, 46 J/1. [4] 46 I/SW., J/NW. [5] 46 M/16. [6] 54 E/8. Division commanded by Gen. Jones had reached Bharatpur 10–2–05 [165]. [7] 54 F/14. [8] 45 N/16. [9] 53 D/4, 30 m. E. of Rewāri, *Imp Gaz.* XVIII (380–1). [10] 46 F/3. [11] 46 M/3.

accompanied. The result of the information gained on these are, however, included in the Field Book, and the names of the towns or Villages will appear on the Sketch.

After the close of the war, valuable information was collected by James Tod, commanding the escort of the Resident with Sindhia, and in 1806 the Surveyor General submitted a

Map which was lately communicated ; ... a truly valuable addition to our stock of Geographical information, ... descriptive of a part of the Country hitherto little known to Europeans, and fixes the positions of Cheitore, Oodepoor[1]...and some other places of great strength and importance on the Western side of Hindoostan, of whose situations we were almost entirely ignorant before[2].

Two years later he reported that Tod

has occasionally employed himself with considerable success in exploring the Countries through which the Mahratta Army directed their March, and lately, while Dowlut Rao Scindhia was laying siege to Raatgur, he proceeded with the Resident's permission by a new and circuitous Route through the districts of Chandery, ... Kirowly, to Agra[3]. From Agra...by another route ...through a part of the Jaypoor Rajah's Territory to rejoin the Escort[4].

The following year Tod forwarded

a Map of my Route from Agra to Sagur[5]. ... It is the fourth I have had the satisfaction of sending to the Surveyor General's Office. ... I shall shortly have sufficient materials for another sheet, with which, & what I have already furnished, all the Blanks in our general Map of this Country may be filled up.

For a long time past I have been employed in collecting Information regarding the North West States & the Tract of Country between the Latitude of Oujehn, Bhopal[6], etc., the Nurbuddah River, and have succeeded very well.

Another subject has likewise occupied a good deal of my attention. I mean the Country to the West of Udipoor & Joudpoor[7] as far as the Indus, and particularly the Country on its E. Border. ...

I mean to construct a Map to contain in a collected view all my routes, with the other Materials I have ; in short, of the Country between the Jumna & Nurbuddah Rivers, marking out the boundaries of the different States ; rise, course, & termination of the different Rivers[8].

The Surveyor General, Garstin, replied that

the information you are now in pursuit of, even if only tolerably correct, will be a valuable acquisition, and greatly assist in correcting the Geography of those parts, which at present is very defective. ... At present I am young in office, and I have much to learn but, as far as my judgement reaches, I am of opinion that your labours in the Field of Science cannot be more advantageously directed than they appear to have been from your own judgement[9].

In other letters Tod writes ;

Whether marching or not, I am never unemployed, having gained almost as much information from Hercarahs as from my surveying in person[10].

The people whom I mentioned as having employed in collecting routes in the Marwar, Bikaner, and Jesselmair[11] countries returned some time ago ; they joined me at Agra, and brought me the fruits of their travels which will prove highly useful. On quitting camp, then at Soppor, they proceeded by Shapoorah, Kisbengurh[12], Ajmer, ... to Jesselmair ; at this place they collected several routes to several places of consequence between it and the Indus. They returned by Joudpoor, ... also collecting routes here to various points. ... The party I sent to the Indus last year returned to camp a few days ago ; ... after quitting Udipur, they travelled westerly to Hyderabad[13], the Capital of the Sindies ; from thence to Jesselmair ; on their route from this place to camp they experienced many difficulties and hardships. I trust their information will prove valuable, certainly there will be much new matter[14].

In 1810 Tod was employed on the survey of the Jumna canal in the Ganges–Jumna *doāb* [67–8] and the following year in Bundelkhand [51]. In 1812 he resumed command of the Sindhia escort, and continued his explorations, submitting a map of his "route from Agra to Kerowli[15], Indargarh...Bahadurpur, Kemlasa and Sagar[16]". He has left the following account of all these surveys ;

[1] Chitor, 45 L/9 ; Udaipur, 45 H/10. [2] BMC. 2–10–06 (102) & DDn. 81 (28), 24–9–06 map, 10 m. to an inch, MRIO. 81 (31), sd. James Tod, 26–8–06. [3] Chanderi, 54 L/12 ; Karauli, 54 F/3. [4] DDn. 81 (139), 20–5–08. [5] MRIO. 29 (17) ; Saugor, 55 I/9. [6] 55 E/7. [7] Jodhpur or Mārwār, 40 East & 45/West. [8] DDn. 82 (70), 9–1–09. [9] ib. 81 (65), 8–2–09. [10] ib. 82 (120), 14–4–09. [11] Jaisalmer, 40 I, J, M. [12] Shahpura 45 K/14 ; Kishangarh, 45 J/14. [13] 40 C/7. [14] DDn. 82 (212), 7–8–09. [15] 54 F/3. [16] MRIO. 29 (21) ; 84 (48, 52).

In accompanying Mr. Mercer[1] in the beginning of 1806...after the termination of the Mahratta War, our route had been surveyed by Dr. Hunter...as far as Tonk Rampoora, [I, 56–7] and as we were to move in a country little known...I ventured to commence surveying it with the most inadequate means, solely for my own gratification. Having joined Sindiah at Oodepoor, and subsequently...passed Cheetore and many other places of note, forming a Survey completely new, of about 500 miles in extent, I had the satisfaction afforded, in crossing Dr. Hunter's line about a degree north of Oogein, that my error did not exceed 6 or 7 miles, and which I have been subsequently able to correct. ...

The Surveyor General reported on it to Government; ... his liberal enconiums, and the gratification I derived in the pursuit, soon made me present another survey of near 400 miles more. These were through Meywar[2], Malwah, to the Boondela frontier, in tracts most imperfectly, and in some parts totally, unknown. The Marches of Sindiah's army, though perplexingly devious, were advantageous, as they carried us to most places of consequence. ...

After this last Survey, Sindiah, having commenced the Siege of Ruhrgurh, ... I prevailed on the Resident to permit me to indulge my wish for accumulating Geographical knowledge, and in 1807, with a Slender guard (10 men), Surveyed a tract of upwards of 1,000 miles, besides obtaining collateral information. ... This route was thus ; Chanderee...direct West, crossing all the Rivers in succession, till I approached close to Kotah ; thence Northward through Shapoor to the Junction of the large Southern Rivers with the Chaumbul ; ... to Agra, from whence... Westwards by a new and intricate road through Bhartpoor and Mutcherry[3] States to Jaipoor, from whence it was my intention to have prosecuted my Journey Westward to Survey the Sambur Lake, and continue to Jodhpoor, but Political circumstances would not admit of this. ... I continued my route by Tonk Rampoora, ... and...joined the Camp at Sagur. ...

I have had many parties who have travelled up both banks of the Indus, and sailed down its streams, and who have crossed the desert in every possible tract from Rajpootana to the Sinde valley. No State [is] contained in my Map, indeed no town of consequence in any of these States, which has not been visited by people whom I have instructed to obtain information. ...

To prevent imposition to which I was necessarily subject in the outsett, I have had the same ground travelled over by different parties, and their information contrasted and confirmed by the natives of each tract, untill I became so intimately acquainted with every portion of ground within my limits, as to know the character of almost every individual feudal Chief, his resources, and adherents[4].

[1] Græme Mercer (1764–1841); Resdt. with Sindhia, 1807–10. [2] or Udaipur. [3] Alwar, 54 A. [4] B Pol C. 25–5–16 (10); Map, dated Gwalior, 18–8–15, MRIO. 94 (11, 12).

CHAPTER V

THE NORTH-WEST FRONTIER

Delhi & Agra, 1803–6 — Delhi Districts, 1805–10 — Advance to the Sutlej, 1809–10 — Elphinstone's Mission to Peshāwar, 1808–9 — Jumna Canals, 1807–10.

IN 1803 war broke out between the Company and the Marātha Confederacy, which comprised Sindhia, Holkar[1], the Rāja of Nāgpur, and the Peshwa, the latter of whom had only just signed a treaty with the British[2].

A Madras army under Arthur Wellesley marched northwards to Poona, and defeated Sindhia's troops at Ahmadnagar, Assaye, and Asīrgarh[3], whilst the Bengal army under Lake captured Alīgarh and Delhi in September, Agra in October[4], and won the decisive battle of Laswari[5], about 30 miles west of Dīg, on November 1st.

On 30th December 1803 Sindhia signed a treaty ceding to the Company his possessions between the Jumna and Ganges (the Upper *doāb*) and the district of Broach, north of Surat. Hostilities against other chiefs continued throughout 1804 in Bundelkhand, Bharatpur, and further west against Holkar ; the fortress of Dīg was captured on December 4th, but the siege of Bharatpur[6] had to be abandoned in February 1805. Operations against Holkar culminated in his retreat to Amritsar, and his surrender to General Lake, who had pursued him to the banks of the Beās [61–2]. Under the treaty concluded on 7th January 1806, Holkar renounced all claim to districts north of the Chambal.

During the progress of the war little survey was done beyond that of marches of various columns, but our interest is not so much in the work carried out, as in the opening up of wide areas over which deliberate surveys could thereafter be extended, and of which the earlier maps gave but scanty information [1].

Amongst the officers who surveyed routes of the "Grand Army" was Carmichael Smyth, who during 1803–4 surveyed the marches from Alīgarh to Delhi and Agra, and on through Fatehpur Sikri to Laswari ; each halting-place marked by the symbol of a double-poled tent and union-jack, with date[7]. Surveyors who know Delhi and Agra in June will sympathise with entries in his fieldbook—April 22nd "Perceiving one of the screws of the Perambulator Lose, sent to the Tents immediately for my other"—June 5th "The wind was so high, and the clouds of dust so thick, that I was obliged to give over surveying at this station"[8].

Thomas Robertson, "Surveyor to the Army in the Field" from January to May 1805, made

> a Survey of the Routes of the Army containing about 170 measured Miles on a large Scale, on which the Face of the Country, with its Forts, Towns, Villages, &c. are distinctly and correctly laid down[9]. ... A Book of Observations for the Latitudes and Longitudes of several Places on the road from Cawnpore to Agrah, Bhurtpoor and Dholpoor, ... very correct and satisfactory[10].

Amongst the meagre maps available before General Lake's advance were contributions from the adventurers George Thomas[11] and Michel Gacoin.

The main feature of Thomas's very rough map, as compiled by William Francklin[12], was "The Country of George Thomas", covering Hānsi and Hissār,

[1] Mahārājas of Gwalior & Indore. [2] at Bassein, 47 A/15, 31–12–02. [3] 47 I/12, 8–9–03 ; 46 P/16, 23–9–03 ; 55 C/7, 21–10–03. [4] 4–9–03 ; 11–9–03 ; 18–10–03. [5] 54 A/14. [6] 54 E/8. [7] *RE PP.* 1882. Appx. III ; & map, pl. viii ; MRIO. 29 (22–5), 30 (2, 7–10). [8] Fdbk. DDn. 78. [9] DDn. 67 (399), 26–9–05 ; Maps, MRIO. 30 (29, 30). [10] DDn. 67 (431), 21–3–06. [11] 1756–1802 ; *DNB.* ; *DIB.* ; *Memoir* by Francklin, 1803 ; Compton's *European Military Adventurers* ; Thorn (480) ; *Statesman*, 31–7–1940. [12] MRIO. 7 (10) ; BM Addl MS. 1390 8(e).

that had been granted to him by the Marāthas. He was completely uneducated, but Gacoin had a fair knowledge of survey, and could observe astronomical latitudes, and Colebrooke writes that,

Mr. Michel Pierre Gacoin, a native of France, who was, some time since, in the service of the Rajah of Jaipoor and others of the country powers in that quarter, and who, on his coming to Cawnpoor in November 1800, was made prisoner by the order of the General Officer Commanding, has lately...communicated to me a map of his travels in Upper Hindustan.

The map showed routes travelled between 1784 and 1800, running from Surat via Baroda to Jodhpur, from *Talner* on the *Tapety* (Tapti) via *Eugene* (Ujjain) to *Jeypour*, *Delhy*, *Agra*, *Aligarh*, *Laknaux* (Lucknow); also to *Lahor*, *Jamou* (Jammu). Longitudes were shown both west from Calcutta and east from *Grenege* (Greenwich). It was covered with remarks in French and notes on astronomical positions, "le tout Dé Dié à Monsieur Colberouk, Surveyor General"[1]. Colebrooke continues;

As Mr. Gacoin has omitted the Bearings of the road, and the names of Places, owing to the French orthography he has used, are not always intelligible, these papers cannot be of any very considerable utility or importance to the Geography of the Country. Yet, as they are better than any other routes or information which have hitherto been procured, ... and will enable me to insert in a new General Map of India [281] several Forts and places not hitherto laid down, ... his geographical communications are worthy of some...Reward[2]. ...

Mr. Gacoin being about to return to Delhy...has offered his services to survey any part of his route which might be thought useful. As he proceeds by water, and intends to navigate the Jumna river in his Budjerow as far as Dehly, an opportunity will be afforded him of adding some valuable materials to the Survey which was taken by the late Captain Hoare [I, 57], and he proposes after that to transmit such other routes and information as his...travels into different parts of the Country may enable him to acquire.

He has at the same time represented to me that, having in this part of the Country little or no means of subsistence, a Sum of money (to the amount of one thousand rupees) would enable him to return to Dehly with ease, and would also furnish him with the means of purchasing a few Instruments. ... At Dehly he informs me he has some little property consisting in a house, and is well known at that place, as well as at other Cities and Places beyond the Hon'ble Company's Territory, having resided many years in that part of the Country[3].

Though Government expressed their dislike of outside help of this sort[4], Colebrooke found the Jumna survey justified a claim for further reward;

Mr. Gacoin, ... who in consideration of a Map and some Geographical Papers...has received a remuneration, has since his return from the Upper Provinces...delivered to me a Survey of the Jumna River in four sheets, which extends from Allahabad to beyond Boria Ghaut[5].

This Survey, which is upon a large scale, besides representing the Jumna River with all its Fords and Ferries, contains also all the Towns, Forts, and Villages on it's Banks...to about 160 miles above Dehly, which part of the Jumna had never before been Surveyed. From the Place where the navigation was stopped by the Rocks and Stones in it's Bed, Mr. Gacoin travelled along the Banks of the River, about 30 miles by land to beyond the first Range of Hills[6], until he deemed it unsafe to proceed further. ...

Mr. Gacoin had the misfortune to be plundered of all the Instruments and effects he was possessed of whilst at Agra, previous to the Capture of that Place [57], and was enabled only to procure others and to proceed on his Journey by the liberality of the Officers who afterwards served at the siege of that Place. He has not received any Donation nor Allowance from the Government since he left Calcutta[7].

THE DELHI DISTRICTS, 1805–10

By treaties signed at the close of the war, the Marāthas withdrew from the area north-west of Delhi, surrendering the districts of Gurgaon, Karnāl, Rohtak, and Hissār. The old blind Emperor, Shāh Alam [I, 24 n.6] was granted a pension and allowed to govern the city of Delhi and a small area round it.

[1] Maps. MRIO. 94 (19); 95 (5). [2] 44 O/12, 16. [3] DDn. 67 (108), 16–6–02. Routes, MRIO. M 229 (57–73) with uncomplimentary note by SG. [4] DDn. 67 (151), 22–11–02. [5] ib. (304), 27–2–04; Map, MRIO. 94 (18). [6] Siwaliks, 53 F/11. [7] DDn. 67 (352), 11–12–04.

The survey of these new districts beyond the Jumna was entrusted to Francis White, who had been surveying the marches of Colonel Ball's brigade beyond Rewāri[1] from October 1805 to March 1806 [*inf*], and had prepared a map of

the country lying within the Triangle of Dilhee, Hansee, & Jypoor, but the part surveyed by me is confined to the districts of Dondree, ... Rewaree, ... and Padshahpoor[2]. ... The remainder of the map is laid down from the best information that I have been able to procure from the Natives ; and, fully aware how much they are liable to err, I have corrected them by procuring a number of routes to the same place by different people [65], and formed their geographical positions by their relative situations to places known[3].

From July 1806 White was put under the orders of the Resident at Delhi, with professional instructions from the Surveyor General [5];

It was only a few days ago that I was made acquainted by the Quarter Master General with your appointment of Surveyor to Colonel Ball's Detachment, since which I have received... an extract of General Orders...appointing you to continue on that duty, and to conform to all such instructions as you may receive from me[4].

As Government have distributed all, or most, of the Conquered Countries to the West of the Jumna among a number of Native Chiefs, a particular Map shewing their respective Boundaries, as well as the British Boundary, is particularly wanted. ... Your General Map should also include the Boundaries of the Seik Territories, and of the Bikaneer and Jaipur Rajahs, the Countries of the Matcheree[5] and Bhurtpoor Rajahs [56], ... and the little District of Badshapoor belonging to Sumroo Begum[6].

The least known of these is the country of Alwar, or of the Matcheree Rajah. With respect to the Bhurtpoor Country, little more is wanted now than to survey the Northern part of it, ... as our Army during the late war traversed the Southern parts of it in various directions, and to ascertain the Boundary Line between it and the British Territory. ...

You need not survey the high Road from Dehly to Agra as it has been already very accurately surveyed by Lieutenant Smyth [57]. ... In like manner the Road from Dehly to Paniput[7] has been surveyed by Captain Blunt [I, 55, 314], and I suppose recently by Ensign Tickell [62] from thence to Thaneisur[8], but some cross Routes are nevertheless much wanted[9].

I request that you will as soon as possible extend your Survey in a South and South Easterly direction from Rewaree, so as to include and ascertain the positions of Tejarah, Noh, Kishengur[10], ... and many other Places of consequence which are situated partly in the newly Conquered Territories, but of which we know little more at present than the names[11]. ...

After surveying the district of Hurrianeh[12]...you should survey the Boundary of the Seeks' country as far as Kurnoul, and to where it terminates at the Jumnah[13].

White was particularly interested in his survey to Hānsi ;

November 14th 1806. The foregoing survey was directed with the view of retracing the route taken by the Guns of Holkar in the months of October and November 1805.

I have been able to trace them as far as Buwalah[14] of Hansee. I am inclined to think that Col. Ball's detachment would have been able to overtake them at Hansee ; the guns must have been retarted in cutting down the jungle to make a road and in getting through the heavy sand. ... Unfortunately the direction of Kanoon was taken...and gave the guns an advantage that could never be regained[15].

He then describes his survey of the hills which run south-west from Delhi through Alwar, and of the passes across them, and continues ;

With respect to the other Ghauts, ... it was my intention to have visited these, but the Rajah, when I had been in his country a few days, was so suspicious of my proceedings as abruptly to order me to quit his country. ... I determined to overrun his country as speedily as possible, for had I attempted to have surveyed it in the regular manner, I would hazard a thousand rupees I should have been directed to leave his country the third day.

This Rajah is possessed of a number of very strong forts, the principal of which is Alwar. ... When I approached within two miles of any of the Forts or Principal Towns, the Wakeel generally took me a circuitous route to the opposite side of the fort, during which I did not

[1] 53 D/12. [2] 53 D/6 ; 44 O/16 ; 53 H/3. [3] Note in fdbk., MRIO. M 343 ; Rough sketches Rewāri to Kanoon, MRIO. 9 (25–31). [4] DDn. 67 (454), 10–5–06. [5] Alwar, 54 A/11. [6] Widow of the notorious Sumru [I, 345 n. 8]. [7] 53 C/15. [8] 53 C/13. [9] DDn. 67 (464), 27–5–06. [10] 54 A/13 ; 53 H/4 ; 54 A/9. [11] DDn. 81 (19), 8–9–06. [12] Covering parts of Hissār & Rohtak Districts, and of Jind & Patiāla States ; *Imp Gaz.* Punjab, I (222–3). [13] DDn. 81 (24), 17–9–06 ; MRIO. 8 (1) ; 12-mile map by Colebrooke distinguishing countries W. of Jumna—assigned to local chiefs—absorbed by EIC. [14] Burwāla, 44 O/15. [15] Fdbk. M 344. Holkar had eluded the columns led by Jones [165] and Ball [*sup*] and also the Grand Army under Lake [61–2].

think it prudent to use the theodolite ; and therefore laboured under much difficulty to correct my horizontal distance ; this was chiefly effected by the observed altitudes of the Sun for Latitude.

Near Laswaree [57]. December 2nd. The Wakeel who attended me on the part of the Rao Rajah had fixed upon this remote spot for my encamping ground, with a view of preventing my approaching near the Town ; but since he had not expressed his intention to me, I took the advantage of an early march, & arrived at the gates of the Town before he could overtake me.

3rd. This day I was of course extremely desirous to ascertain the exact positions of the several villages in the vicinity of Laswaree ; and I hoped I should have been able to have obtained some interesting particulars relating to that glorious victory ; but which in the confusion & hurry of action, had been passed over unnoticed. The Wukeel however positively prohibited my going to Laswaree, & I am well convinced gave secret directions to the zummendars, &c. of the villages near which I passed to give false answers to my enquiries. ...

5th. At night I received a visit from the Wukeel who mentioned that the Rajah was averse to my surveying in that direction, or to my remaining any longer in his country, & had therefore given directions for a Risala[1] to accompany me to the British Frontier.

In reply I expressed my astonishment at the sudden change in the disposition of the Rajah, who had been acquainted with my intended route three days back. That I was not in the least desirous of remaining longer in the Country than was agreeable to him, and should therefore in the morning take the direction of Rewaree ; at the same time I begged to forward him my best acknowledgements for the attention I had received from the Qilledars and Ameels of the several Forts & Towns near which I had encamped.

6th. ... The Rajah had become so extremely suspicious of the Survey, ... that I was fearful lest my deviating from the direct route to Rewaree should occasion some disagreable occurrence ; on the other hand I was very desirous to ascertain whether there was any other Ghaut besides that of Kishengurh...through which Guns, &c., could proceed ; I therefore determined to direct my march...by Tijaree[2], by which route I should never be at a greater distance than five miles from the hills. ...

7th. During this march I was accompanied by a Rasala of the Rao Rajah. I did not therefore attempt to take bearing of the few villages that were to be seen[3].

The Surveyor General appreciated his enterprise and discretion ;

I am happy to learn that you have succeeded so well in carrying your Survey through the Matcheree Rajah's country. ... I apprehend from the difficulties and impediments you have lately met with, that it will not be practicable for you to make any further attempts to complete the Survey of the Matcheree Rajah's country. Indeed enough has been done for the purpose of general Geography in that quarter[4].

I have been favored with your latter from Surindee, along with the Map of Part of the Rao Rajah's and Bhurtpoor Countries, which I have reduced and inserted...into my General Map. ... There is little hope that you will ever be able to penetrate further to the West in *that* direction, but I hope you will be more successful in surveying the Country to the N.W. of Dehly *between* the two high roads leading to Hansee & Paniput. ...

It is a curious circumstance that all the Rivers in that Country appear to have a Northerly Course, in a direction contrary to that of the Jumna, and that some appear to lose themselves in the Sands of Hureanah & Bickaneer[5].

At the same time he reported to Government that White had

made great progress in surveying the Country to the Westward of the Jumna, between Paniput, Dehly, and Agra but, as the difficulties he meets with in consequence of the jealousy and suspicions of the people in those remote parts of the Country are very great, it is probable that he will soon have completed all that is likely to be practicable, for some time, in that quarter[6].

Government welcomed the possibility of saving money, and ordered White's recall, as a set-off against the expenditure to be incurred by Colebrooke's survey in the Upper Provinces [29, 112]. A further dispensation was, however, granted on the Surveyor General's request

that, as permission has been obtained by the Resident at Dehly from the Sick Chief, Bhaug Sing [64], for surveying certain parts of his Territory, it would be desirable that his Survey should be prolonged for a period of two Months. ... I am actuated only by a wish to promote the acquisition of Topographical knowledge in a part of the Country which, in a Military point of view, is certainly of great importance, and I am convinced, from the zeal and ability which

[1] Cavalry party. [2] 54 A/13. [3] Fdbk. M 344 maps, MRIO. 8 (17); 12 (10); 94 (6). [4] DDn. 81 (51), 19-1-07. [5] ib. (59), 20-2-07. [6] ib. (61), 12-3-07.

Lieutenant White has displayed in conducting the Survey of the Countries on the Dehly Frontier, that he is actuated solely by the same fine motives[1].

This survey took White away to the west, and his fieldbook shows that he was at Bhatinda on June 13th, and returned to Delhi towards the end of the month. At the Resident's request his appointment as "Surveyor on the North-West Frontier" was extended indefinitely.

In the interval of working up his maps[2], he was employed for several months on a survey of the old Jumna Canal between Karnāl and Delhi [67], and he started a survey of Karnāl cantonment[3] [*inf*] before resuming his survey of the frontier to the south, which he reported complete by July 1808 ;

The British Boundary from the River near Kurnaul as far as the Zillah Agrah ascertained, and a general Knowledge of the Country included between Kurnaul, Patialah, Hissar, Rohtuk, Rewarree, and Agrah acquired. A Map comprehending the whole of my Survey on the North of Agrah, on a scale of four miles to an inch, will I trust by the expiration of this month be in readiness for transmission to Government[4].

His next task was a detailed survey of the immediate neighbourhood of Delhi, completed between August and December, which the Surveyor General described as

A Plan of the City of Delhi, and a Map of the Country for near Ten Miles round it, which would be very useful in case of another attack on the Capital. It is a Survey principally taken with a Plain Table [229], ... but the quantity of labour required to complete this work shews that this Officer has been fully employed during the five months[5].

He closed this survey in January 1809 with

a particular survey to the Badlu Seraee, the gate of which can be seen at a considerable distance ; ... part of a measured base from the Jumma Masjid, for the purpose of taking a Trigonometrical survey of the Environs of Delhi[6].

Amongst other large-scale maps of Delhi is a very neat plan of the interior of the fort "reduced from a large Hindostanny Map of that City"[7]. There is an excellent coloured sketch entitled "A view of the Eastern Face of the Palace of Dihlee", shewing the Jumna flowing close up to the eastern wall, with two sailing craft in the foreground, and pointers in Persian characters. This may have been the work of Robertson, Smyth, or some other artist surveyor of the period[8].

There is a most interesting plan of the city, 200 yards to an inch, signed by Peter Lawtie 13th December 1812, which shows the old city gates, including the *Kashmere Gate* and also the *Koorseah Bagh*, and the road outside the city wall[9].

Surveys of cities and important cantonments became a matter of special concern at this time, and in January 1810, the Commander-in-Chief ordered

Correct Surveys to be made of all Military Cantonments, the want of which is Constantly Experienced ; But owing to the Scarcity of Engineer officers the object is not likely to be accomplished within any reasonable time. His Excellency therefore deems it advisable to employ Infantry or other officers whenever any Possessing Suitable qualifications can be Spared. ...

Captain Raper [46], ... a very intelligent Officer, and who is particularly qualified for the duty in question, has been directed to make the requisite Surveys of all the Cantonments appertaining to the Delhy and Rewary Command[10]. ...

Ensign Ellis [69], having completed a correct Survey of Kurnaul Cantonments [67], &c., is directed to proceed to Suharunpoor to survey that Post, which when finished, he will proceed to Loodhiana and take a Survey of those Cantonments[11].

ADVANCE TO THE SUTLEJ, 1809–10

Between November 1805 and February 1806 Lake marched his Grand Army up to the Beās River beyond Jullundur in pursuit of Holkar [59 n.15][12]. Friendly relations were maintained with the independent Sikh chieftains of the country, and

[1] DDn. 81 (79), 14–5–07. [2] MRIO. 8 (2–8) ; 9 (25–6) ; MRO. Map 546. [3] Fdbk. MRIO. M 344. [4] B Pol C. 5–9–08 (1); Map, MRIO. 94 (13). [5] BMC. 6–5–09 (102); Map, MRIO. 183 (24). [6] Fdbk. ib. M 345. [7] ib. 183 (22). [8] ib. 7 (8, 9). [9] ib. 183 (23). [10] BMC. 16–1–10 (43). [11] ib. 3–4–10 (8). [12] Thorn (479–512).

also with Ranjīt Singh, who had at this time laid no claim to territory east of the Sutlej.

A route survey was kept by Richard Tickell[1], shewing the march up through Patiāla and Nābha, and the return through Sirhind and Ambāla, but, much to the disappointment of the Surveyor General, no astronomical observations were taken for lack of instruments :

An opportunity may perhaps never occur again of carrying a survey through the Punjab, where certainly nothing of the kind had ever been done in a satisfactory manner before.

A single observation for the latitude correctly taken at any one of the places where the Army encamped in that remote country, or on the banks of the Beyah River, would be of the utmost value to Geography, as we have not upon record any celestial observation made in the Punjab, except one which is quoted by Captain Wilford as taken at Calanore by a Padre who accompanied the Emperor Akbar in his Expedition to Kabul in 1581[2], but which, from the imperfection of instruments in those days, cannot be relied upon within probably half a degree[3].

I need hardly mention that, as Mr. Tickell's survey must have been made in rather a cursory manner, owing to the rapidity of the movements of the Army, it is not likely that his route will make up for the deficiency of Astronomical observations, or that at the remotest point of it he should not have fallen into considerable error with respect to latitude and longitude. ...

The march of the Army into the Punjab has appeared of such importance in a geographical point of view that I have already had an application...from Colonel Reynolds [286] for a copy of the Survey, and one also from Captain Wilford, who has constructed a map of the Punjab from the information of Natives, but which for want of actual measurement and celestial observations must be liable to considerable errors [I, 234][4].

In 1808 it was rumoured that Napoleon was planning the invasion of India, and British envoys were despatched to Persia, Sind, Kābul, and Lahore, to counter these designs [1, 65, 168, 173]. Charles Metcalfe[5] led the mission to Lahore where he found Ranjīt Singh[6] ambitious and difficult ; the small Sikh states east of the Sutlej had already appealed for British protection against him.

Metcalfe left Delhi in August, and in November the Governor General decided to support him by sending British troops forward to the Sutlej, to emphasize the easterward limits of Ranjīt Singh's dominions. To effect this object Ochterlony's force occupied Ludhiāna on 17th February 1809, and on 25th April Metcalfe successfully concluded a treaty which Ranjīt Singh faithfully observed till his death over 30 years later[7].

Metcalfe's route to Lahore was surveyed by Benjamin Blake[8], and White was appointed surveyor to Ochterlony's force ;

The course of events and transactions having rendered it expedient to advance a detachment of the British Troops at some position on this side of the Sutledge, and not far distant from that river, and the Right Honorable the Governor General in Council, being anxious to take advantage of the march of that detachment to obtain a complete survey of the Country between the North West frontier of our Territory and the Sutledge, has been induced by the experience of your ability in the art of surveying, and by a consideration of the progress you have already made in the Survey of the Country of the Sikh Chiefs, to appoint you to that service.

The March of the detachment...will remove most of those obstacles which impeded your former Survey. ... You will accordingly be pleased to be prepared to accompany the detachment, which will proceed from Muttrah, in the capacity of a Surveyor. ...

The Governor General in Council is particularly solicitous that no part of your proceedings should furnish ground of jealousy or apprehension to the Chiefs and Inhabitants of the Country, and you will keep this object constantly in view. If any obstacle should arise of this description, you will apply to the Officer in Command of the detachment, who will probably be able to remove it by proper representation. ...

P.S. You will be pleased to observe strict secrecy regarding the measure of forming the detachment and the point of its destination[9].

[1] MRIO. Fdbk. M 541 ; Map, 12 (33–6). [2] Father Monserrate, with whose Map & *Commentarius* [I, 11, 209, pl. 10] Colebrooke was obviously unacquainted. [3] His latitudes had a mean error of about 11 minutes from the truth [I, 149]. [4] DDn. 67 (448–9), 3–5–06. [5] Charles Theophilus Metcalfe (1785–1846) ; Writer, BCS. 1800 ; Resdt. Delhi, 1811–20 ; Hyderābād, 1820–7 ; Lt Govr. NWP. 1836–8 ; cr. Baron, 1845 ; *DNB.* ; *DIB.* [6] Succeeded to rule at Lahore 1792 ; d. 1839. [7] Account of mission, HMS. 511 (33). [8] DDn. 81 (51), 12–10–09. [9] B S & Sep. ; DDn. 82 (56), 14–11–08.

White's fieldbook opens ;

In January 1809, Accompany Genl. Ochterlony's brigade on march to Ludhiana, carrying on route survey.

Patiala Feb. 3rd ; ... Ludhiana 15th[1].

Ochterlony reports that,

having through the intervention of the Envoy of Lahore procured a protective passport from the Rajah, and a confidential person from the Diwan, ... Lieut. White left this post on 27th ult. on his survey of the South West District, escorted by a guard of a Jemadar and 30 Regulars, and a few of the Horsemen belonging to the Mulavi Patans, and furnished with letters to all the Thannadars. ...

Lieut. White proceeds by...Faridkote, ... Batindah, ... to Sirhind and, skirting the eastern hills by Nahan and Narain Ghur, will direct his course to Roopar[2] on the Banks of the Sutlege, and down the Banks of that river...to this Post, embracing a General Survey of the Country occupied by the Southern Chiefs, and reserving for more leisure and future Excursions a more minute examination of the interior Towns and Villages[3].

The trip was not without adventure ;

May 1st. On my arrival near Durumkote[4], several shots were fired at me, though fortunately without effect ; ... the Thannadar with a body of Sieks of about 40 horse and the same number of matchlock men came towards me, and began to act in a very hostile and imperious manner. I attempted to explain to him that I had the Permission of Runjit to proceed through the country, and was accompanied by one of his Chobdars, but this was so far from answering the purpose that the Sieks laid hold of the unfortunate Chobdar, and gave him such a beating that I thought they would have murdered him ; they were not sparing in their abuse to me, and from their conduct I evidently saw I must be plundered of all my effects. Resistance from so small a party would have been unavailing, and must have occasioned our total destruction, for besides this body there could not have been less than 200 armed men in the town, and on every side were large villages belonging to Ranjeet Singh which made a retreat impossible. ...

The ten Horsemen were so much intimidated that they were of no use to me. ... I accordingly informed some Sikhs that were within two or three yards of me that they were welcome to the baggage, ... but if they attempted to molest us we had of course nothing to do except defending ourselves to the last ; the muskets were all loaded, and the sepoys determined. This conduct of mine appeared to surprise them. ... After some consultation they permitted the baggage to proceed, but insisted upon my returning from Runjeet's Territory, and a party of them accompanied me to near Simdeh, where I am at present encamped[5].

May 3rd. Halted...from severe indisposition. ...

May 15th. Survey to Sirhind and Umballah[6]. ...

Since my return from Durumkot I have surveyed the high road to Amballa, and from thence intended to have proceeded to Nahan and return along the foot of the hills to Ludhiana. By this route I should have become acquainted with the position of Nahan, which has for a long time been a geographical desideratum, and a point which Colonel Colebrooke was particularly anxious to ascertain, ... but unfortunately a letter from Colonel Ochterlony directing my return reached me at Amballa and, supposing some arrangements might have been made for my proceeding to the westward, I was forced to relinquish all my plans. ...

By the little deviation from the high road I have become generally acquainted with all the principal places lying between that road and the first range of Hills. ... In so extensive a survey as mine, that of the high road is of the greatest importance, on account of it's serving as a base of the whole of the survey, from which the several offsets are made. ... It was upon this account I proceeded direct from Ludhiana to Amballa, though it had been already surveyed by Lieut. Tickel[7] [62].

Starting out again on June 17th, White worked up to Nāhan, returning to Delhi in September, and submitting

a Map of the Country between Delhi and the Sutlej, bounded on the East by the Jumna and Nahan Hills, on the North by the River Sutlej from Makowal to Ferozepore, and on the West by Ferozepore, Batinda, and Batner.

The Country East of the line drawn from Dhurumkot to Patialah, and from thence by Jheend to Hansee and Khiro[8] may be considered as laid down from actual survey ; the extensive tract West of this line as drawn from the information of my Munshee, who for that purpose with several Hircarahs was sent into the Becar country.

[1] Fdbk. MRIO. M 345. [2] Rūpar, 53 B/9. [3] BSC. 3–6–09 (4) ; also HMS. 595 (451). [4] 44 N/1. [5] HMS. 595 (439), 10–5–09. [6] Fdbk. MRIO. M 345. [7] DDn. 84 (174), 28–5–09. [8] Jīnd, 53 C/7 ; Kairu, 44 P/14.

The Sikhs on the overthrow of the Mussulman Empire appear to have been particularly anxious to destroy every document in the Kanoongoe's office which could in the least tend to facilitate the restitution of property, and also to have adopted the Mahratta policy of apportioning the Towns and Villages amongst their followers without any regard to their local situation.

This intermixture of Towns and Villages has rendered the delineation of the Boundaries of the different Chieftains almost impracticable ; my wish to render the Map as useful as possible has nevertheless induced me to trace some of the principal divisions. ...

The Map[1] is constructed on the small scale of eight Miles to an Inch, being merely intended to point out the principal Towns and Villages ; it contains about 22,000 square miles, 3,600 of which is supposed to be subject to Runjheet, 5,800 to Rajah Sahib Singh[2]. The same number to the British Government, and the remaining 6,800 is divided between Bhai Sal Singh, Bhaugh Singh, and the other Allies of the English[3].

After a few weeks in Delhi, White returned to the field, working down to Bhatinda from Patiāla but on 18th December, his party was attacked and plundered ;

While on my Survey in Rajah Sahib Singh's country near Batinda, I was attacked by a large party of Sikh Horse and foot, which after a considerable resistance on our part finally succeeded in plundering me of all my Baggage and effects of all description ; even my rough... book, which was in the hands of one of my Hircarrahs, is unfortunately lost. 3 sepahees were killed and eleven wounded ; 3 Servants killed and 3 Wounded ; 3 Horsemen Wounded ; both of my Horses killed, and four others Wounded, two of which were left behind as incurable. My party consisted of a Surt and 68 Sepahees, and a Daffadar and 10 Irregular Horse [363–5][4].

A considerable part of his papers were recovered later, but his surveys had to be suspended. His maps and reports about the Sikh states were of the utmost value, and in April 1811 the Surveyor General reported that,

Lieutenant F. S. White's communications of his Survey in Battinda are satisfactory, and, being of a country hitherto almost unexplored by Europeans, prove a valuable addition to our stock of Geographical knowledge, tho' not conveying a minute description of it. His opportunities of Surveying being restricted to the Marches of the Detachment, in a Wild and almost desert country, whose savage Inhabitants would inevitably have cut off any small Party separated from the Main Body of the Troops[5].

A few months later he was transferred to take up the survey of the Upper Ganges–Jumna *doāb* [6, 36–7].

Other officers surveyed routes through Sikh country, and here we have the first record of young Hodgson at survey ; he writes to the Surveyor General, Garstin, on 15th November 1809 ;

We came down from Luddianah and left the Pattiala Road near Narbah[6], turning to the S. & E., ... and I surveyed a route which no corps has marched. I have the pleasure of sending you a Field Book of my Route to Rohtuck[7] (where I now am), ... which I hope may be useful to you, if you still amuse yourself with Protractions. I am preparing a Map for you which I will send when I have Surveyed more of the Country.

I am at present...with...the Commissioner, and in the course of his settling the Country I will measure the Roads, etc. ... Can I do anything else for you in the Wilds of Hurriana, or procure you anything rare, tho' truly this Country produces little but Jungle ; from the Bhatinda Country fine strong Horses (fit for carriages) may be had at 4 & 500 Rs. ; from Bikaner excellent Seawarree (or State) camels ; they are noble animals and can trot an incredible Distance in a day ; their paces are quite easy, & the great men of the Western Provinces use them for riding on, as I do here. ...

Have you any Idea of coming up the Country again ? The climate here is pleasant in the cold Weather & Rains. It really would be a fine Country if there was Water ; the Inhabitants are extremely robust and Healthy Men and very brave.

I hope some of these days to go to Bikaner. I think if you were again in the West of India you would explore the Course of the Indus from Multan to the Sea, ... for surely the Indus is the natural Frontier of Hindostan, and its Navigation ought to be in our Hands.

I was preparing you a Plan of the Fort at Hissar which I measured by the method you did the Fort and Town of Luddianah. I expect to be at Hissar again and will then make it more perfect. ... Excuse my scant paper, as Stationery is now short in this Jungle[8].

Garstin reported to Government that he had received

[1] Maps, MRIO. 10 (2–4); 12 (8); 13 (26, 33); Fdbk., ib. M 344. [2] of Patiāla. [3] DDn. 82 (92), 7–10–09. [4] ib. (79), 25–12–09. [5] ib. 128 (11), 12–4–11. [6] Nābha, 53 B/3. [7] Rohtak, 53 D/9. [8] DDn. 82 (53).

the Route of Major Adam's detachment from Ludhiana to the Fort of Hansi, kept by Lieut. Hodgson, which, although not a finished, or even a correct, performance, contains useful information and shews a turn for Observation[1].

He asked Hodgson to collect information about the canals of the Emperor Feroze Shāh [69], and Hodgson promised

a Map and Fieldbook of my Route from Rottuck thro' the Southern part of Hurriana, ... if the Hon'ble Mr. Gardner, on whose Escort I am, should visit those places, and will gain every information I can respecting Feroze's Canals, and if possible will trace the Bed of the Chutung... from Hissar upwards[2].

At the end of 1810, James Paterson made a survey from Ludhiāna to Sahāranpur[3], and during January and February 1812 Alexander Gerard surveyed the road to Lahore when Ochterlony attended the wedding of Ranjīt Singh's son[4]. Gerard later surveyed the route of his battalion from Ludhiāna via Karnāl and Meerut to Bareilly[5].

Ochterlony himself took a particular interest in map-making, and amongst the routes he collected was one of the

Road to Cashmere from Loodianah by Umritsur, Jummoo, with a detail of Villages, Jungles, Wells, Rivulets, & Nullahs, by Roosul Singh & Ghussain Dass, 1809[6].

ELPHINSTONE'S MISSION TO PESHĀWAR, 1808–9

Whilst Metcalfe's mission to Lahore was by far the more urgent and successful, yet Elphinstone's mission to the King of Kābul, which in the end proved unfruitful, was more particularly interesting from the geographer's point of view. The kingdom of Kābul at that time extended from west of Herāt to the Indus, and even included Kashmīr and, to avoid the territory of Ranjīt Singh, Elphinstone marched via Rewāri, Multān, Dera Ismāil Khān and Kohāt, to Peshāwar, where he found the Amīr, Shāh Shuja.

With Tickell as surveyor, and Macartney commanding the cavalry escort, the mission left Delhi on 13th October 1808, and reached Peshāwar on 25th February, being well received everywhere. Returning through Lahore, they arrived back in Delhi in September 1809[7].

From the start, Macartney took a large part in the survey, and afterwards prepared a great map of the Punjab and Afghānistān, which was based first on the perambulator traverse kept by him and Tickell, controlled by frequent observations for latitude, and then filled in and extended by a multitude of routes collected by enquiry from people of all sorts [59].

Mr. Elphinstone commences his march at 5 P.M., and generally arrives at his ground between 12 & 1 [at night], so that no *bearings* of the road can be taken ; and were they, on the other hand, to march in the day time, the Suspicions of the people would not admit of the Perambulator being used[8].

The Surveyor General sent Tickell

a Gold Chronometer, the property of the Hon'ble Company, to enable you to make the Astronomical observations necessary to correct your Survey ; as this instrument is a very valuable one, you will be pleased to acknowledge the Receipt of it, and carefully restore it to the Office on your return.

The Spectacles are of a particular construction, calculated for the preservation of the Eyes from the reflection of the Snow. ... If I can obtain a second pair of spectacles, they shall be sent Tomorrow for the use of Mr. Elphinstone[9].

As the mission did not get beyond Peshāwar, there was no danger from the glare of snow, and although Macartney "estimated the mountains of Hindu-Kush at more than 22,000 feet", they were more than 120 miles from him at Peshāwar. Two of the party attempted to reach the summit of the Takht-i-Sulaimān[10].

[1] MRIO. Fdbk. M 344 ; Maps, 10 (5); 11 (16); 13 (30). BMC. 19–12–09 (138). [2] DDn. 82 (75). 4–1–10. [3] MRIO. Fdbk. M 541 ; Map, 13 (21). [4] Fdbk. DDn. 162 (3); DDn. 128 (113), 1–9–12 ; *Ludhiana Records* (278). [5] MRIO. 13 (5, 6); Fdbk. DDn. 162 (4). [6] DDn. 270 (36). [7] Minto (161); Murray, II (488–516). [8] White to SG. 9–11–08 ; DDn. 82 (41). [9] DDn. 81 (35), 11–10–08. [10] 39 E/14 ; 11,085 ft., J. S. Cotton (65).

Macartney wrote from Peshāwar ;

I have the honour now to forward by Dawk a Copy of my Field Book up to the 6th of December to Bawelpore[1]. It is accompanied also by the Longitude of Derah Ismeel Khan, which I conceive to be of great consequence in the present Survey, particularly as it comes within ½ a mile of the Route laid down. ...

I shall forward the remainder of my Field Book as soon as possible, but I have really had so much of my time taken up in obtaining Cross routes and information regarding the nature of the Country, that I could not possibly get it all ready. These routes shall be forwarded to you when they are compared and arranged[2].

The surveys submitted included

a Sketch of the part of the Courses of the Indus & the neighbouring Rivers, and also a route from Muttra to Moultan, both executed by Lieutenant Macartney[3]. ...

Several sheets of the Survey made on the Journey towards Cabul[4] ; ... the Drawings are neatly finished, contain very valuable information, and will determine several important Geographical Points, whose situations are erroneously laid down in all the Maps hitherto extant[5]. ...

From one height [near Peshawar] Lieutenant Macartney took the Bearings of 32 villages, all within the circumference of four miles[6].

Lieutenant Macartney's Route from Delhi to Pesshour[7] agrees so well with His Field Book that I consider it a very valuable acquisition, & the more so as severe indisposition has prevented Lieutenant Tickle from furnishing the office with the remainder of His labours[8].

Tickell returned from Peshāwar in advance of the mission, surveying the route "to Meerut via Pind Dadad Khan & Lahore"[9]. He wrote to Macartney on 13th June, probably from Amritsar ;

Dear McKartney, We arrived here after a prosperous journey, though tedious, on the 10th. I start tomorrow, when I trust we shall have no more halts till our arrival at Delhi, which we may expect to reach in the course of six or eight months [weeks ?].

I have knocked the sun about with some success, high as he is, and find a good horizon by means of the Theodolite and a Lead & string ; which hung up, by its shadow, shows the bearing of the said sun, & enables me to bring him down to that part he is actually over ; there is no situation almost that you cannot find a Horizon, the further of course the better.

Underneath is a list of those Latitudes took, which may be of use for correcting your routes, and to compare with your observations hereafter.

I have picked up some famous Qasids[10], perfect Gazetteers, and drawn all their teeth for our adventures. ... I am just now operating on an unfortunate Hurkarrah ; and about 50 Kashmere merchants waiting outside, laden with all the precious manufactures of that sweet country.

How does our friend Shuja come on ? Report says the Imperial Spears are *not yet* turned to the west, and that *Akram Kan* is no better than he ought to be.

Pray remember me most kindly to Mr. Elphinstone & Mr. Whirter[11]. ... The heat is very great every day, & it is with difficulty I can write my F. Book & Journal. What do you say to 104° & 6° roze-roze[12] ? in the coolest part of the shade, & by day 113, 7, 8 & 9 are common. You cannot be much worse at Peshawar.

Remember me kindly to Raper, Bob Sikunder[13], White, Taplin, & all friends, and believe me, dear Mak, yours most Truly, R. Tickell.

[Then follow half a dozen latitudes of places in the Punjab[14]].

Elphinstone warmly supported Macartney's claims to draw full surveyor's allowances ;

I may venture to say that no survey made in the Provinces can be more accurate than that of Lt. Macartney ; while the superior degree of diligence and address necessary for acquiring the requisite information in such countries as those the Embassy has passed through, and the additional expence necessarily incurred by the Surveyor, as well as the higher importance of the knowledge acquired, are too evident to require any remark[15].

Hodgson's professional opinion, given in 1821 as Surveyor General, was more critical

The positions of Peishwar, Lahore, Mooltan, and Bikaneer, are taken from the late Mr. Macartney's Determinations, which I do not think quite correct. I suspect that they may

[1] Bahāwalpur, 39 O/11. [2] DDn. 82 (148), 20–4–09. [3] ib. (151), 6–2–09. [4] MRIO. 3 (4–7) ; 12 (2, 9–25). [5] SGs'. report, DDn. 81 (95), 13–5–09. [6] J. S. Cotton (68). [7] MRIO. 12 (11), 13 (8). [8] DDn. 126 (3), 24–3–10. [9] DDn. 82 (208). [10] or *cossids* [I, 42 n.6]. [11] possibly John McWhirter, asst. Surg. Bo Mar. [12] Day after day. [13] Robert Skinner (*c.* 1783–1821) Local comn., Skinner's Horse Hodson, IV (581). [14] DDn. 40 (ii). [15] B Pol C., 10–10–09 (37).

err, in particular points, to the amount of from 6 to 8 miles in Latitude and Longitude, but as they were taken on an actual, though not very good, survey, they may be considered as an approximate standard to check the other two maps[1] [285].

THE JUMNA CANALS, 1807–10

The ancient Mughal canals that watered the country to the right and left of the Jumna[2] had been allowed to fall into disrepair and disuse during the period of Marātha supremacy, and not long after the British occupation of Delhi the Resident at Delhi was authorized to have them put into order ;

It is essential that a regular Survey should be made of the Canal, and that an estimate should be formed...of the Expense which would be incurred in the execution of the work. ... The whole course of the Canal should be within the British Territories, and...its former Bed should consequently be connected with the Jumna by a new cut[3].

White was entrusted with the survey, and the following are extracts from his field books[4] ;

August 31st 1807. This survey of the Canal...is in general conducted along the bed of the canal. ...

Sept. 17th. ... The bed of the Canal was choaked with high grass, intermixed with small babool trees ; the Country for more than a mile on each side of the bank was a complete jungle ; there appeared to be no material difference either in the breadth or depth of the canal, & as it was a desideratum to become acquainted with the villages on each side...I thought it to be of more utility my quitting the Canal, and proceeding as near the jungle admitted along its banks. ...

Oct. 7th. The Resident being desirous of bringing the water from the Jumna into the Canal at, or below, Kurnal if possible, to prevent interfering with the country belonging to the Independent Chieftain of Koonjpoorah, I this day proceeded to the Sheikhpoorah Ghaut[5] with the intention of taking a level from that place. ...

8th. Commenced on the level from the river ; ... I got so completely bewildered in the low jungle and high grass with which the country is overrun, that I was under the necessity of relinquishing the attempt.

[After a further attempt the following day] ; each of these surveys employed me eight hours, from six in the morning till two in the evening. being delayed in lopping away the branches of the jungle, till I was under the necessity of making zigzag stations, and a few of these irregular, where the theodolite could not be placed exactly in the centre. ...

Oct. 20th. The length of this level is only four miles, but the country being much overspread with jungle & intersected by Nullahs, the levels were not finished till the 24th.

The few days that I was under the necessity of remaining at Kurnal for instructions from the Resident at Delhi were fully employed in taking a plan of the Cantonments [61][6]. ...

The first part of this month [November 1807] was employed in taking a plan of the Cantonment at Karnal and an outline of the town, & in taking another level, 7th November, from the River to the canal & back. The river was 7 feet above the level of the canal[7].

In June 1809 the Surveyor General was directed to nominate two Engineer officers to report on the work necessary

to open the two Canals, ... the former of which ran heretofore near to the City of Dehly, and the latter through a part of the Dooaub[8].

He replied,

that it requires very different qualifications to make a Survey to take levels of these Canals, and to carry so extensive a work into execution and, if I may presume to offer a suggestion, it should be that two distinct persons be employed on this Duty. The one to make the Survey, take the levels, and enquire the price at which Tanks are dug, and earth is removed, in those parts of the Country ; ... the other to Superintend the Work. ...

For the first mentioned duties, I consider Lieutenant Tod, who has long been employed as Surveyor [55–6]...as well qualified. ... He may survey one Canal, and Lieutenant J. Macartney, who accompanied the Hon'ble Mr. Elphinstone to Peshawar, ... can do the other ; all the Engineers in the Upper Provinces being at present fully employed[9].

[1] the two maps by Arrowsmith and Reynolds. DDn. 196 (90), 18–9–21 ; as check against Arrowsmith and Reynolds. [2] Emperor Feroze Shah constructed some of these, A.D. 1357 ; Thorn (507) [3] BRC. 5–10–07. [4] MRIO. M. 344–5. [5] Karnāl, 53 C/14 ; Kunjpura, 53 G/2 ; Sheikpur, 53 C/16. [6] Fdbk. MRIO .M. 344. [7] ib. M. 345. [8] BJC. 2–6–09. [9] BMC. 5–12–09 (176).

Tod was accordingly allotted the canal on the left bank of the Jumna watering the *doāb*, whilst Macartney surveyed the Shāh Nahr on the right bank, which had been examined by White. On 1st May 1810 Tod submitted

a Survey Plan of the Jumna from where it leaves the Mountains. ... In the Survey is laid down the head of the Canal opened by Mohammad Shah about 7 years before his death, which places it about the year 1741.

It was ever after neglected by his Successors, but a part of it...was cleared by Zaptah Khan 40 years ago, then Fouzdar of Saharnpoor. From that period it has been at Various times cleared as far as Behut[1], 15 miles from its head, by the Zamindars ; the last time about 14 years ago, more from its being necessary to existence than for irrigating their lands. Their sole dependence here is on a few wells which, if dried up, ... the Inhabitants must quit their villages.

From the proposed new cut to this Village, a distance of $5\frac{3}{4}$ miles, there is not a drop of Water, and here only a single well, from whence the water is carried several coss to the surrounding Villages, and so apprehensive are they of its failing that they have contributed each a little towards bringing Water from the Jumna at the point laid down in the Plan ; they have commenced, but have only cut 8 yards in a month. ...

In the accompanying plan I have put down everything that appeared worthy of remark, perhaps too minute, particularly noticing Banks, Rapids, etc., with 2 sections of the River at the former, and now proposed, head of the Canal[2].

To this the Surveyor General replied ;

You seem to mistake what is at present required. It is a correct Survey of the Country between the Jumna and the Ganges down to Anopsheer[3] on the latter, and a few Miles below Delhi on the former. ...

On this general Map all Canals, Cuts, and Watercourses, are to be traced, and Towns, Forts, Villages ; ... let all canals be marked in deep Blue. ... After this is done, the Canals must be laid down on a larger scale on other paper, and all streams that come from the Hills traced as far as possible. The Hills from which they issue [must] be carefully laid down, and the width of the openings thro' which any stream passes particularly marked ; do. the height of hills, so as to enable me to calculate the expense of making a dam across the Valley, which could form a Head of Water. ...

Your letter contains some useful information, but it is not sufficiently arranged to lay before Government, who should have complete details of every particular...to save trouble, and their time, that is very valuable[4].

Macartney worked on his survey from 1st April to 20th December 1810;

I...arrived at the point..., on the 25th April, where the Jumna breaks off into two branches, 2 miles South of Fizabad[5], near where the hills approach its right Bank. ...

Having been ordered to a particular point, I proceeded accordingly, and found everything favourable for making a new head & cut, as will appear by the accompanying Sections and Sketch in Plan No. I. I examined the River in all its windings, up and down, taking what levels I thought necessary for fixing the exact point for the new head. ...

I thought it might be right to Survey other points of the river, conceiving that a considerable expense might be saved...by bringing the Cut from some near point. I consequently Surveyed a Point 13 miles [below], near which it appears to me a most excellent spot for a new head and cut[6].

To further directions from the Surveyor General he replies ;

I had fortunately carried all your orders into execution, excepting the height of hills, and the population of the country which would derive benefit from the water of the canal ; as this latter business would require a considerable time to survey a country 130 miles long by from 12 to 18 miles broad, and the rains having set in, and being obliged to take advantage of every fair hour during the day, and the whole country being a complete sheet of water, I thought it better to go on to Delhi, conceiving that the plans of the canal, and as much of the country as I could lay down, might be required quick, and knowing that the other part could be executed at any time.

I therefore hope that you will approve of what I have done, and take into consideration the season in which I have been employed [Delhi, April to July !], and that to complete the work it has taken me from 6 to 8 hours each day, all the hot winds, and a great part of the rains. ... I have brought on the survey to the gate of Delhi, but have not yet gone to the water's edge, which I must do, as I commenced from the water[7].

[1] Behat, 53 F/12. [2] DDn. 82 (178). [3] Anūpshahr, 53 L/7. [4] DDn. 126 (33), 31–5–10. [5] Faizabad, 53 F/11. [6] DDn. 82 (211), 8–6–11. [7] ib. 147 (51), 30–7–10.

Garstin reported to Government that,

since the end of the official year, the important and fully detailed Surveys of the ancient Canals, on the Delhi side of the Jumna by Lieutenant Macartney, and in the Dooabb by Lieutenant Tod, have arrived ; an immense number of Sections are laid down by both these officers[1].

Their Papers are under examination for particular report ; from the Drawings it is evident they have spared no pains to execute the orders they received, and to convey the fullest information on the subject in their power to acquire[2].

Further action was not taken till 1816, after the conclusion of the Nepāl War.

During his survey to Hissār in 1809 [64–5] Hodgson had been much impressed with the potential value of the old canals, and reported that

the people...expressed their hopes and wishes that our Government would restore the old Canals formerly dug by the benevolent Prince Feroze Shah [67 n.2] which, whilst they were in order, conveyed blessings to the whole Country through which they passed, ... [and, continues the Surveyor General], the desire of having these Canals repaired will probably induce the principal Chiefs thro' whose territories they run to permit an Officer to measure and carefully examine every branch of them, and thereby afford an excellent opportunity of obtaining a correct Survey of a Country we at present are utterly ignorant of. ...

I am further induced to propose the Survey there by an Officer named R. Ellis [61], now attached to the Pioneer Corps who, I am credibly informed, possesses all the qualifications requisite[3].

No action was taken on this proposal at the time, but ten years later substantial progress had been made in the restoration of these canals under the able superintendence of Rodney Blane[4].

[1] MRIO. 160 (13, 15–24, 70–84). [2] DDn. 128 (11), 12–4–11 MRIO. 8 (9), White's map of country W. of Jumna, 10 m. to inch, with line of canal added by Macartney. [3] BMC. 19–12–09 (138). [4] Cautley (5) gives history of *doāb* canal.

CHAPTER VI

HIMĀLAYA MOUNTAINS

Nepāl — Source of the Ganges, 1808–15 — Lake Mānasarowar, 1808–12 — The Dūn, Garhwāl, & Sirmūr — Snowy Range — War in the Hills, 1814–5.

IN 1801 a treaty was made with the Gurkhas under which Captain Knox[1] was appointed "Resident at the Court of Nepaul" at Kātmandu, with Charles Crawford in command of an escort of "two complete companies", and Francis Buchanan as "Surgeon to the Residency"[2].

The treaty had but a short life and was formally cancelled in January 1804, after the withdrawal of the Resident. During this short period, however, Crawford had made important surveys and, with Buchanan, collected a mass of geographical information.

The mission left Bankipore[3] in January 1802, and on 19th February entered the Nepāl dominions, being met

on the banks of the Buckiah River by one of the Wiziers and two of the Chief Ministers, who had with them the Rajah of Betoul and his brother[4].

Crawford's journal continues with descriptions of the road and mountain scenery. Distances were estimated; stars were observed for latitude; the cuckoo was heard.

The mission withdrew in March 1803[5], and the Surveyor General had much to report;

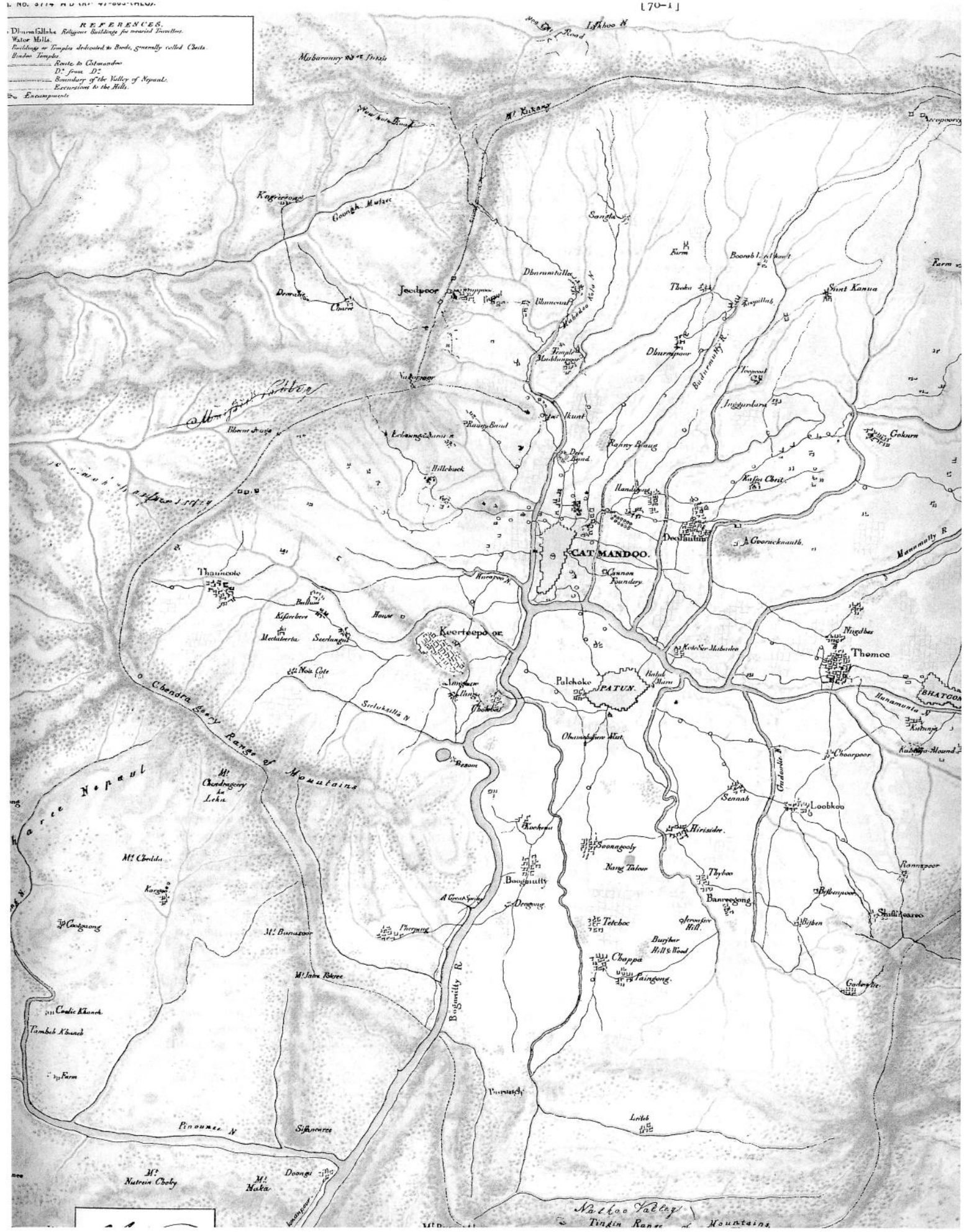
Having understood from Doctor Buchanan, who is lately returned from Nepal, that Captain Crawford, who commands the Resident's Escort at that Place, has surveyed a considerable portion of the Country, and that he proposes, provided Government will authorize him, to continue his Geographical Labours by a Survey to be taken during the ensuing cold season from Hardwar to the Teesta River [6, 27, 85–6], I now take the liberty of communicating...what Captain Crawford has already done. ...

"Captain Crawford [writes Buchanan] has settled the Longitude and Latitude of *Catmandu* by a numerous series of celestial Observations, and has formed a Map of the Valley of *Nepaul* on a large scale, constructed trigonometrically with great exactness and immense labour [pl. 8]. He has preserved a register of the whole observations, both of the celestial bodies, and of the horizontal angles, so that the accuracy of the whole may be at any time computed by any professional man.

"He has also formed another map, in which is introduced the former reduced to a smaller scale, and he has added our Journies from *Gorasan* to *Gor Pursera*, and from thence to *Catmandu* by *Chitlang*, and our return back by *Pherphing* and *Seggouly*[6]. To this he has added all the parts adjacent to the valley of *Nepaul* proper that he could ascertain from the summits of the hills which surround that country. Many of the intermediate points, together with the extremities of this Map, are fixed by Astronomical Observations and cross Bearings of known objects; so that, although there is no measurement of the roads, there can be no material error in the manner in which they are laid down. This map shows the routes connecting *Nepaul* with the low country[7].

"He has next constructed a Map more conjectural, and on a smaller scale. It comprehends all the dominions of *Nepaul*, from near *Hurryduar*[8] on the Ganges, to the Teesta, together with the bordering parts of *Thibit*, *Gorwhal*, etc., from *Gangutri*, or source of the *Ganges*, to Diggarchee[9], the residence of the Teshoo Lama, ... together with many of the peaks... ascertained by him from Nepaul from the fixed points of this Map. The remainder he is endeavouring to fill up from the routes given him by Merchants, religious Mendicants, and

[1] William Hunter Douglas Knox (1762/3–1829) Ben. Cav. [2] BMC. 20–11–01 (90). [3] near Patna. [4] Journal, MRIO. M 245. [5] Clements Markham (lxxix). [6] Ghorasahan, 72 F/1; Chitlang, 72 E/2; Sagauli, 72 B/9. [7] MRIO. 91 (25). [8] Hardwār, 53 K/1. [9] (?) Shigatse, 77 C/15.


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Dharmsallahs Religious Buildings for wearied Travellers.
Water Mills.
Buildings or Temples dedicated to Bodo, generally called Chaits.
Hindoo Temples.
Route to Catmandoo
Do from Do
Boundary of the Valley of Nepaul.
Excursions to the Hills.
Encampments
CAT MANDOO.
PATUN.
BHATGOO
Thamcote
Kwerteepoor
Thamoe
Pulchoke
Chandragiry Range of Mountains
Nepaul
Jeodpoor
Dhurmpoor
Gokurn
Sennah
Loobkoo
Hirisidee
Thybo
Banreegong
Chappa
Taingong
Tetchoc
Boodhanilkanth
Sheopoory
Misbaranny
Kagrieseang
Sangla
Farm
Thoka
Sunt Kanua
Nuggbee
Choarpoor
Ranneepoor
Bijbenpoor
Bijben
Shuddeearee
Gardenee R.
Boodhanilty R.
Mananally R.
Bagmatty R.
Pinoumee N
Sirsacoree
Mt Nutrein Choby
Mt Maka
Doongi
Mt Jaira Rokree
Mt Burnaswor
Mt Cheldu
Mt Chandragiry or Leka
Cheadic Khaneh
Tambeh Khaneh
Nathoo Valley
Tingin Range of Mountains

other travellers, connecting them as well as he can with the very inaccurate map of the Northern frontier of the Company's provinces to be found in Rennell [I, pl. 14].

"The materials which he possesses for the parts near Nepaul on the branches of the Consi and Gunduc are numerous and tolerably satisfactory. The remoter parts towards the East and West are very incomplete.

"He is therefore anxious to be employed on a survey that would enable him to throw much light on the whole country between the Company's provinces and the snowy mountains. He proposes beginning at *Hurryduar* on the *Ganges* and proceeding East to the Teesta, laying down accurately the frontier of Nepal, and the entrance of all the rivers coming from thence to *Oude* and *Bengal ;* and all along as he proceeds he would investigate so far as can be done by information received from travellers, the sources from whence these rivers spring"[1].

The documents submitted by Crawford on his return comprised ;

Map of the Valley of Nepaul, upon scale 1¼ inches to a mile [pl. 8][2].

A Map more extensive (but scale reduced), comprising Captain Crawford's Route from Singaulee to Catmandu, and some of the Ranges of Mountains beyond the Valley to the Distance of a few miles[3].

A Map in which Captain Crawford has exhibited upon a scale of 5 inches to a degree the whole of the above, and, inserted from information procured at Nepaul, the situation of Gangautri, Budrenauth, Sreenagur[4], and Dugurtcheh (near Lassa), with the intermediate routes leading to those places[5].

Trigonometrical Operations for a Survey of the Valley of Nepaul, &c.

Short Account of the Valley of Nepaul, &c.

Synopsis of Observations for the Latitude of Catmandu.

Synopsis ,, ,, ,, ,, Longitude ,, ,,

Table of the Distances & Altitudes of the principal Peaks of the Himaleh, or Snow Mountains, from the Valley of Nepaul.

Seven Drawings of the Himaleh Mountains from the Valley of Nepal [85] ;

besides several routes collected from information[6]. The Surveyor General, Colebrooke, found the maps "executed with particular neatness", and wrote to Crawford in May 1804 ;

Your Friend Buchanan[7] has at length succeeded in drawing the attention of Lord Wellesley to your Survey of Nepaul, and His Lordship has further been pleased to direct that the Survey you proposed of the Northern Frontier, &c., be commenced when the Season will permit.

I enclose a Copy of the Memorandum which Dr. Buchanan laid before His Lordship, upon the back of which His Lordship wrote an Order in Pencil, directing me to prepare Instructions for you accordingly[8].

He directed Crawford to

to proceed on a Survey of the Northern Frontier of Bengal, commencing at the Coosa River[9]. ...

You should proceed to Nauthpoor [I, 77, pl. 14] with your instruments by Water, so as that you may commence the Survey early in October next. During your stay at that Place you will be enabled to make some Inquiries into the nature of the Country beyond the Hills, the previous Course of the Coosa River before it enters Bengal, and to ascertain the Distances of such of the Himaleh Mountains as may be visible[10] [85–6].

Crawford carried out this survey during the cold weather of 1804–5, and refers to it in a later letter describing the possible routes into Nepāl[11] :

I acknowledge there is a great difference between Colonel Kirkpatrick's map [I, 75–6] and mine and, whilst I have the greatest respect for such authority as his, yet I am induced to lean to my own route from the following reasons ; that I marched to Catmandoo like himself, where I remained a twelve month, and whilst there I took 180 observations for the Longitude [and] a great many more for the Latitude.

I have since been at Nauthpoor, whose Longitude and Latitude I also settled, and went up the Koosie as far as Bururooah ; from this and from Nathpoor I took a triangle to obtain the Bearing and distance of Beejapoor, which place is visible from both places ; this therefore settles the exact situation of Beejapoor ; lastly I have been within a very few Coss of Janickpoor[12] ; having thus exactly obtained these grand points, I have then to lay in the routes that I obtained whilst in Catmandoo.

[1] DDn. 67 (212), 13–5–03. [2] MRIO. 89 (3). [3] ib. 91 (25) ; Copy presented to R.E. Museum, Chatham, 1940. [4] in Garhwāl. [5] MRIO. 89 (1). [6] BPC. 22–3–04 (33). [7] now Surgeon to the GG. [8] DDn. 67 (506), 5–5–04. [9] Kosi R., 72 N. [10] BPC. 31–5–04 (25) & DDn. 67 (317), 11–5–04. [11] B to CD. (Sec) 27–12–14. [12] Bijapur, 72N/5 ; Janakpur, 72 F/14.

Colonel Kirkpatrick's book was not published when I completed my Surveys, therefore I could not in any wise borrow from him[1]. ...

When at Nathpoor I went with Mr. Smith[2] [I, 77] as high as Bururooa, and he then informed me that he had been as high as Bra Chatr, from whence he saw the junction of the Tumboor and Koosi[3] ; from his description I laid down the Koosi above Bururooa and, in looking over the records of the office, I stumbled upon his Sketch of the Koosie which had been sent to the Surveyor General 20 years before [I, 77 n.10]; with it I send my own that I sent to Colonel Colebrooke from Nathpoor, to shew how exactly they agree. ...

In all the conversations I...had in Nepaul on the subject of the Koosi (for we were obliged to be very cautious in our questions), I was always induced to believe that it was not navigable beyond the first range of hills. ...

In collecting Routes from the Natives they in general prove often very contradictory, which renders the laying down such routes extremely difficult ; indeed all that is to be done is to make the road agree as well and as nearly as possible with them all. ... As the windings in the jungle and among the hills must be great, I would not hesitate to give a mile in every six in addition [197–8]. ...

As the level of the Nepaul Valley is a good deal below that of the Chitlang valley, the descent is greater than the ascent ; thick woods cloath the faces of this range ; the road is not only very steep, but there are immense blocks of stones to get over, that rendered it very difficult for our horses to get down ; one tattoo with us was killed by falling down one of the precipices. After we arrived in Nepaul I remember a courtier of the Second Class of the Nepaul Durbar assured us that he had rode his hill-horse all the way over the Sissapanee range. One thing I cannot help remarking, and that is, the very great difference between the manner our horses and the Hill horses managed to get up the mountain ; ours, not accustomed to any ascent of length, commenced with all their vigour, wishing to get over it with all expedition, by which means they were soon exhausted ; the Hill horses on the contrary commenced most leisurely, and when a little way up they stopt to take breath, well knowing what they had to encounter ; they then ascended a little higher again stopping, and so on to the top ; by which means they arrived fresh in comparison with our horses, and I would strongly recommend this mode to men as well as for horses. ...

In coming back from Catmandoo we returned by the Pherphing and Kangoo road. ... From its winding up along the steep side of the mountain, and from its narrowness, it is somewhat dangerous for cattle to travel this road. Here we encountered [a merchant] and some drovers with a drove of Buffaloes, who told us he seldom got over this part of the Road without losing one or two of his Buffaloes. ... It may here be asked, if this road is found to be dangerous to cattle (by their sliding over the edge of the road, down into the deep and steep vallies below), why the drovers do not go by Chitlang ; the only answer I have to give is that the descent from the Chandrageeree gaut is not only very steep, but the difficulty and danger for cattle is increased by the size of the pieces of rock that are to be got over, and the height of one piece above another. ...

Accompanying I have the pleasure to send you with this 17 Routes collected whilst I was in Nepaul[4].

Besides collecting several routes and much information from native sources during 1802–3[5], Buchanan continued his interest in Nepāl geography till he left India in 1815, when he was able to provide several maps for the use of the military staff [40][6]. In his *Account of the Kingdom of Nepal*, he writes ;

During the years 1802 and 1803, I passed fourteen months in the country, mostly in the vicinity of Kathmandu, the capital. ...

The account of Sikim is chiefly taken from a Lama, or priest of Budha, ... who constructed a map of the country which I have deposited in the Company's Library. Besides the Lama, I have consulted many of the natives of the Company's territory who visited the lower part of Sikim, and several of the Gorkalese and other people of Nepal ; and Mr. Smith, of Nathpur favoured me with several particulars. ...

A Slave of the Raja of Gorkha entered into my service in order to bring plants from the Alpine regions, but finding him very intelligent, and a great traveller, I employed him to

[1] The Adjutant General had asked Crawford, 27–1–14, to reconcile his maps with those of Gerard and Kirkpatrick of 1793 [I, 75–6]. [2] Wm. Bruce Smith, indigo factor & trader in saltpetre ; resided 25 years at Nāthpur ; arrd. India c. 1770. [3] Chatra, 72 N/1 ; Tumbur R. joins Kosi 72 N/1. [4] DDn. 131 (89), 8–8–14. [5] Sketches, MRIO. 89 (11–19). [6] BSC. 23–5–15 (19) ; one of them might have been "a Map of the hilly countries West from the Dominion of Gorkha, on the authority of Hariballabh, drawn by Kamal Lochan ; scale 5...coss to the inch" ; including Kangra on the west ; MRIO. 89 (7–9).

construct a map. ... In order to enable him to execute this with more care, he refreshed his memory by several journies in different directions [354].

A Kirat from Hedang, near the Arun River, gave me another map. ...

These two maps, together with that of the Lama, as might be expected, are very rude, and differ in several points ; but they coincide in a great many more, so as to give considerable authority to their general structure. ...

The general authority of the whole is confirmed by our maps, so far as they go, and by the intelligence which Colonel Crawford obtained in Nepal[1].

Buchanan illustrated his book with a *Map of the Dominions of the House of Gorkha*, scale 35 miles to an inch, stretching from Bhutān to Lahore, and showing the principal ranges and river systems.

Amongst other maps collected in 1814 was one described by Wilford as "made by order of the Rajah of Nepaul above 35 years ago, and sent to Mr. Hastings. It was upon a very large scale. It is no great things"[2].

An account of the various surveys made along the Nepāl frontier during the war of 1814–6 is given elsewhere [38–43].

SOURCE OF THE GANGES, 1808–15

We have told of early legends and speculations about the source of the Ganges [I, 70–3], and the unravelling of its secrets had long been dreamed of by Robert Colebrooke. He had included it among the tasks for Crawford 1804–5, had welcomed an offer by Gacoin[3] that came to nothing, and in 1807, when on survey in Rohilkhand, he got permission to visit Gangotri himself;

Having long doubted the account which is given by Major Rennell of the origin of the Ganges at Munsaroar Lake[4], and being moreover inclined to adopt the opinion of Dr. Francis Buchanan and Lt Colonel Crawford who visited Nepal in the year 1802, and whose information... acquired from intelligent people in the hilly country appeared liable to few objections, I determined, as soon as the opportunity should be afforded me, ... to attempt myself to proceed to the celebrated spot where the Ganges is said to force a passage through the Hymalia Mountains, or, in case my own want of health or other circumstances should preclude my undertaking the journey, to depute...some other officer in my stead[5].

He successfully overcame the reluctance of the Gurkhas to allow strangers into the hills;

Having been desirous of attempting to discover the real sources of the Ganges by a journey to Gangoutri, I applied some time since to...the Governor General's Agent at Benares, requesting that he would endeavour to ascertain through the Nepaul Rajah's vakeel at that place how far the objections of the Nepaul Government, to whom the whole Province of Sirinagur[6] now by conquest belongs, might thwart me in the accomplishment of such a design. ...

The result of my application was extremely favourable. ... As far as depended upon his Government, I might proceed to Gangoutri in perfect safety, and he again wrote to Nepaul, sending at my particular request the names of two other Gentlemen[7] who had wished to accompany me on so curious and interesting a journey. ...

The season which is most favourable for going to Gangoutri I understand to be the commencement of the hot weather, and I have reason to believe that the whole journey might be performed in two months from Hurdwar or Seharunpoor[8].

The Governor General in Council wrote officially to Nepāl in support of this arrangement, but at the same time agreed that Colebrooke

should be left to prosecute or abandon his design according to the information which he may acquire, and to the dictate of his own discretion, recommending to him at the same time to be cautious of placing himself within the power of the Governor of Srinagar without being satisfactorily assured of protection[9].

In March 1808 Colebrooke found that he was not fit for the journey [32–3];

Lieutenant Webb being so well qualified, ... and having moreover offered his Services for

[1] Hamilton (1–3). [2] MRIO. 84 (23) is a reduction made by Wilford which had been passed to Lindesay [43]. [3] DDn. 81 (61), 20–2–07. [4] but cf. Rennell's account [I, 73]; Colebrooke was probably thinking of Wilford [78–9]. [5] Note in Colebrooke's fdbk., DDn. 73, M 470. [6] Garhwāl, 53 J. [7] obviously Webb and Hearsey [33]. [8] DDn. 81 (105), 5–12–07 ; BMC. 14–12–07 (44). [9] B Pol C. 21–12–07 ; BMC. 11–1–08 (129).

performing a Journey to Gangoutri, I take the liberty of recommending him. ... A speedy answer to his proposal should be sent, as the season favourable...will be immediately after the breaking up of the approaching Fair at Hurdwar.

Should it meet with the approbation of Government, Lieutenant Webb begs to solicit the favour that Captain Raper of the 10th Regiment, ... and Captain Hearsey who is with me, might also be permitted to accompany him[1].

The necessary sanction was given, and an escort provided ;

Letters were carried by a Brahmen Hirkarah (a Native of Nepaul) who had been deputed by the Nepaul Rajah's Vakeel at Benares to accompany me in my travels, accompanied by a Chuprashi of my own who is also a Brahmen. On the return of the two deputies from Srinagur, Lieutenant Webb, accompanied by Captain Raper...and Captain Hearsey, will commence their Journey into the Mountains[2].

Webb was directed

to Survey the Ganges from Hurdwar to Gungoutri (or the Cow's Mouth), where that River is stated by Major Rennell to force its way through the Hymalaia Mountains by a Subterraneous passage [I, 73], but is said by some Natives who have visited the spot to fall from an eminence in the form of a cascade. ...

To ascertain, either by Survey or...report, the distance and direction of the second or Upper Gungoutri, which Captain Wilford informed me is considerably further. ...

To learn whether this (should there be such a place) or the former be actually the Source of the Ganges, or whether, as Major Rennell has stated in his Memoir it rises from the Lake of Munsaroar. ...

To fix...the positions of the Sources of the Aleknundra River at Badrinauth, and of the Kedar River which joins it above Srinagar. ...

To enquire how far the source of the Jumna River lies to the West or N.W. of Gungoutri. ...

To ascertain generally the positions of all the most remarkable peaks in the Himalia Range, taking their elevations to the nearest minute by a Theodolite, and drawing the appearance they present to the eye.

The situation of all Towns, Forts, Places of Hindee worship...will be included, ... and an accurate delineation of the Road. ...

The distances may occasionally be measured with a perambulator and, where the declivity is too steep, by a chain, making an allowance for the Angle of elevation. ...

If a Barometer...should be obtained, ... the height of the mercury...will furnish a rule to calculate the elevation...above the level of the Sea, which, being added to the results obtained by Trigonometrical calculation, will give the heights of some of the principal Snowy Mountains. ...

It would be desirable that Lieutenant Webb, after completing the Survey from Hurdwar... should return, if practicable, by a different and more Easterly route, through Almora to Bareilly[3]

Webb wrote from Hardwār

that he has been very favourably received by the several Goorkali Chiefs whom he had met at the fair, who informed him that Orders had been sent from the Nepaul Rajah to afford his Mission every assistance. ...

The only untoward circumstance he mentions is that the expense of his Journey, owing to the exorbitant demands of the Hill People for carrying the Tents and necessary baggage of himself and his Party, would far exceed anything he could have supposed[4].

Turning up the Dūn after leaving Hardwār, the party crossed the range to the east of Landour without reaching Dehra, and dropped down to Bārāhāt on the Bhāgirathi. They followed the broken track along the river but on April 29th were turned back just beyond Raithal, about 20 miles short of their goal. It was impossible to carry sufficient supplies, or to complete the remaining five or six stages of hair-raising scramble, without risk of disaster to all their plans. Webb writes from Srinagar on the 15th May ;

I commenced my Route on the 13th ultimo, and...arrived on the 23rd at Barahath. The Road was not only difficult but dangerous, and many parts of it in any other situation would have been deemed impassable. ... A day's Journey of six or seven miles could not be completed in as many hours.

On my arrival at this place, calculated at 10 days March from Gungoutri, I was informed by Natives who had visited the place that it would be impossible to proceed beyond Butheree[5],

[1] BMC. 21–3–08 (79). [2] From SG. 26–3–08 ; BMC. 25–4–08 (67). [3] 53 O/10 to 53 P/7 ; ib. (68).
[4] From SG., 20–4–08 ; BMC. 2–5–08 (90). [5] Batwari 53 J/9.

two days from hence, ... and that it would be necessary to take sufficient supplies from thence to last till my return.

Determined, however, not to relinquish the attempt till I should be convinced that the impediments were of a nature to render the prosecution of my researches in this quarter impracticable, I made the necessary arrangements on my arrival at Butheree on the 27th ultimo, with the intention of continuing my Route. ...

The party halted on the 28th and,

having left a guard in Charge of the Baggage which was too heavy to be carried on, I proceeded the next morning, but in a progress of three or four miles...I found the difficulties so far exceed what had been represented, that I was fully convinced it would be in vain to persevere, and I was at length induced to return. ...

Every account agreed that the Source of the River is more remote than the place called Gungoutri, which is merely the point where it issues from the Hymalia, not, as it is related, through a Secret passage or Cavern bearing any similitude to a cow's mouth, ... although the access be so obstructed as to exclude all further research. ...

To supply as well as possible the deficiency occasioned by my abandoning the Tour, and to ascertain satisfactorily the correctness of the accounts I had received, I despatched an intelligent native, furnished with a compass, and instructed in the use of it, with directions to visit Gungoutri [76]. ...

I am in hopes to be enabled to proceed about the 17th instant, when it is my intention to follow the course of the Aluknundra River...as far as Badreenath, returning thence through Almora and Rooderpoor[1] to Bareilly. I am informed that Orders have been recently communicated by the Nepal Government to its Officers to afford our party every assistance and we have reason to be perfectly satisfied with the attention and respect which has been uniformly manifested towards us[2].

Having obtained "the full Concurrence and sanction of the Nepalese Government" he now proceeded to explore

the Aluknundra River in the direction of Badreenath. At that place I arrived on the 29th [May], and on the following morning continued my Survey to that point of the River which may be denominated its visible Source, for beyond it the Road is impervious from the accumulated masses of Snow which conceal the current. ...

I commenced my return on the 1st instant, with the intention of taking a more Easterly Route by the way of Almora, to which place the hire of the Coolies and Bearers had been fixed by the Chief of Srinagar.

No impediments were thrown in my way till my return to Joshee Muth[3], two marches from Budreenath, when an Hurkara arrived from...one of the principal Surdars, with an indirect prohibitory Order,...the purport of which was to annul the permission granted me to continue my Journey to the place of holy pilgrimage.

The delay of the Messenger defeated the object of his Mission, for the case was now irremediable, and I had only to lament the first signs of an unfriendly disposition on the part of the government. ... When I was prepared to continue my Route on the morning of the 4th, the people who were entertained to carry the public and private baggage had absconded. ...

I had only one alternative, which was to lose no time in proceeding to Almora with what few articles could be conveniently carried on by private servants, as the distance from Srinagar was too great, ... and the season was already so far advanced, that a retreat from this unhealthy climate will be considerably restricted, if not entirely cut off, by the periodical rains which had already commenced.

Having therefore left the greater part of the public and private property under the charge of the Goorkallee Jemadar who attended me from Hurdwar, ... I proceeded on foot. ... Thro' the Jemadar's exertions however the baggage was brought up in the evening, and thro' his influence I was enabled to proceed with little interruption for four days, when a couple of Sepoys...overtook the party, ... and delivered to the Jemadar the most positive orders to return, and at the same time forbade the Zamindars, under threats of heavy fines and punishments, to furnish any people for the conveyance of the equipage. ...

Having once more relinquished the greater part of the Baggage, ... I reached the boundaries of the Srinagar District on the morning of the 13th without further interruption. This part of the Journey...was attended with fatigue and difficulty and...occasioned serious cause of alarm from the number who were falling sick daily. ...

On the evening of the 14th instant, I was met by a Goorkallee Subadar...with two com-

[1] Rudarpur, 53 P/5. [2] BMC. 13–6–08 (65). [3] Joshīmath, 53 N/10.

panys, ... for the purpose of detaining my party till the Chiefs at Almora had satisfied themselves as to the nature of the Journey. ...

Although the distance from Almora did not exceed 14 or 15 miles, six days elapsed before any decision took place, but on the evening of the 19th, the Messenger returned. ... Permission was granted me to proceed by any other Route than that which leads thro' the City of Almora ; I accordingly mentioned my determination to return by the way of Rooderpoor, and having obtained permission...I continued my march the next day, accompanied by a small party of the Goorkallee Troops. ...

Nearly a third of the party are unable, either through lameness and sickness, to keep pace with the detachment. ... Should no further impediments occur I hope to have the honour of reporting my arrival at Bareilly on or about the 2nd proximo.

P.S. Since writing the above I am happy to inform you that the greater part of the Sick have arrived[1].

They joined Colebrooke at Bareilly on June 30th[2] [5].

A full account of the expedition by Raper was published in *Asiatic Researches*[3], as was also the journal of the *munshi* whom Webb had sent on from Raithal. Leaving Webb on May 1st, he had reached Gangotri May 6th, recording his paces as he went. The width of the river was noted at the many bridges crossing it,

but at Gangawatari...the stream is described...to be 40 cubits wide and two deep, with scarcely any current. The river was traced 3 miles further amidst the snow[4].

Webb took some months to complete the maps from his extensive materials, and he writes to Garstin, who had succeeded as Surveyor General ;

The protractions of my late Survey were, by the particular desire of Lieut. Coll. Colebrooke, drawn out in sheets on the scale of one inch to a Mile[5]. ...

I have not made any calculation respecting the distance of Peaks from cross bearings taken at different situations on the road, supposing the data...too imperfect to give a nearer result than that which will be obtained by laying off...in protraction. ...

It is indeed to be regretted that my preparations for this Journey were so unavoidably hurried as to have obliged me to set out without a Chronometer, Astronomical Telescope, or Barometer. ...

[Two mountain barometers were unfortunately broken on the way up from Calcutta].

In a Mountainous country where the difference of elevation between Stations is so great, and alters so rapidly, I know of no method (except a series of levels were taken) from which the height of an object very remote from the Plain could be ascertained with any tolerable degree of precision. Even Barometrical observations though the best method can only be considered as affording a good approximation. ...

The Maps were completed while suffering from the effects of a severe illness, and instantly despatched agreeable to Coll. Colebrooke's particular wish ; indeed he had promised me a Copy of the Plan, when reduced in his office, for my own private satisfaction[6].

As I have promised, and am very desirous, to present Mr. [H. T.] Colebrooke[7] with a copy of the reduced Plan, I shall be most particularly obliged if you would be kind enough to place it in the hands of some well qualified draughtsman, for the purpose of having a handsomely finished one prepared, with the names of Places and a Title neatly inserted, and present it from me to Mr. Colebrooke when completed. I will be answerable for any expence which may attend its preparation[8].

He wrote at the same time to Henry Colebrooke ;

I have at length, February 6th, 1810, completed the Reduction of my Survey[9] towards the Sources of the Ganges, which is this day forwarded...to the Surveyor General. My inability as a Draughtsman...rendered this, though I trust a very correct, a very ill finished performance ; I have therefore begged Colonel Garstin to place it in the hands of some capable person for the sake of being handsomely copied, of which copy...may I hope you will honour me by your acceptance [pl. 9]. ...

The Abstract of Material Positions obtained is as follows, and I am perfectly satisfied with the correctness of all the Results, excepting that of Kedar Nath, and even this cannot fail of being a very near approximation.

After a list of ten positions with latitudes and longitudes, he continues ;

[1] From Webb, Rudarpur, 28–6–08 ; BMC. 18–7–08 (73). [2] DDn. 81 (146). [3] *As R.* XI, 1810 (446 *et seq*) ; cf. HMS. 645 (531) ; Murray, II (391–404). [4] *As R.* XII. 1818. (277–93). [5] MRIO. 15 (32–5), 32 (78–85) very clear, with Webb's characteristic long-haired caterpillars. [6] DDn. 82 (46), 23–11–08. [7] Colebrooke pubd. a paper on Webb's journey, *As R.* XI. 1810 (429 *et seq*), which preceded Raper's Report [*sup*]. [8] DDn. 82 (111), 8–2–10. [9] 6 m. to an inch, MRIO. 15 (7) [pl. 9].

Considering the most important information acquired to be a knowledge that the sources of the Ganges are southward of the Himalaya, I subjoin my reasons for adopting this opinion.

It had been universally experienced during our Journey that the supply of Water from Springs and numerous tributary streams were sufficient, in a course of eight or ten miles, to swell the most minute Rivulet into a considerable and unfordable stream. ... Now the banks of the Bagheratee and Aluknundra Rivers were followed till the former became a Shallow, almost stagnate, and the latter a small, Stream and, both having in addition to Springs and Rivulets considerable visible supply from the thawing snow, it is therefore concluded by analogy that the Source of these Rivers could be little, if at all, removed from the Stations at which these Remarks were collected.

2nd. The channel of a great River is usually a lane to which the contiguous country gradually slopes, and...the sides of a River always furnish the most practicable Road in the direction of it's course. Now, if the Bagheratee or Aluknundra River had an outlet through the Himalaya, it appears more than probable that the Channel of its stream would form the Ghattee[1] by which the Snowy Range became passable. ... As it is utterly impossible to cross the Snowy Range in a direction the Channels of these Rivers might be supposed to assume, I consider that at least all former reports are determined fictitious.

3rd. I have conversed with two or three intelligent Natives, whose information I found correct in other instances, and who have in Pilgrimages and on business traversed the Northern skirts of the Himaleh, and I have their assurance that no Rivers except one rise westward of the Mansaroar Lake ; that this stream is called the Suturuz R.[2], and turns Southerly, west of Jumootie[3].

Colebrooke accepted these conclusions ;

I entirely subscribe to the arguments of Lieutenant Webb, which to my apprehension are conclusive. No doubt can remain that the different branches of the river above Hardwar take their rise on the southern side of the Himalaya, or chain of snowy mountains.

From the western side of the mountains, after the range, taking a sweep to the north, assumes a new direction in the line of the meridian, arise streams tributary to the Indus, and perhaps the Indus itself[4].

Colebrooke could not tell that Webb had indeed missed the fact that both branches really do rise from the northern slopes of the great snowy range, a point that would not be obvious from the bottom of the gorge, though quite clear on a complete map[5] [78]. This is, however, a small matter to be set against Webb's clear establishment of the locality of the source.

The Surveyor General was impatient for the

reduced Plan of the Survey of the Gangoutri, as well as that for the General Map. I understand Major Hearsey has sent one Home. I much wished to have been able, by the last dispatch, to have sent a General Map of those Countries from your Hand, as well as the 12 sheets of the Survey, and still hope to have them in time for the March Fleet[6].

Hearsey had indeed tried to steal Webb's thunder ; he had sent his own journal[7] home to Rennell by private hands, with a full account of the tour, and a request that Rennell would pass it to the Directors ;

As this Tour was undertaken at our individual expense, may I beg of you to present the sketch[8] to the Hon. the Court of Directors, should they deem it worthy a remuneration, whatever their liberality may award, ... or permit private publication.

As no person has given such a Correct Chart of the Geography of India as yourself—[Hearsey asks leave to dedicate to Rennell this, his first essay][9].

The Directors prudently prefered to await official information from Bengal, and a few months later, 25th June 1810, they received this dignified apology from Rennell ;

Maj. Hearsey thought proper to transmit it to me as *his own production*, ... setting forth that the expedition was undertaken by a Party at their own expence ; and requested that I would endeavour to obtain Remuneration for him. ... Thus informed I readily undertook what I thought a meritorious act (for the map is certainly a very curious one, and bears the stamp of Truth, as far as *Internal Evidence* goes), but I have since been informed that the Person who sent it me only copied another man's work, with a view to obtain something for himself[10].

[1] defile. [2] Sutlej, 53 A, E, I. [3] DDn. 82 (113), 6–2–10. [4] *As R.* XI (444). [5] See 53 M and Burrard & Hayden (117, 181–2). [6] DDn. 81 (200), 25–1–10. [7] dated 13–12–08. [8] Map by Hearsey. 10 m. to an inch, MRIO. 163 (14); carries pencil note by Hodgson, "This map was pirated from Capt. Webb's documents" when "Webb fell sick at Bareilly". [9] BM Addl MS. 26653 (1). [10] ib. (14).

Early in 1814 Hodgson asked the chief at Srinagar to obtain permission for him to visit Gangotri, but relations with the Gurkhas were strained, and the project fell through. Mackenzie, who was with Hodgson at the time [83–4], was much interested, and hoped that "tho' it has in this case failed for the present, I hope the spirit will not be allowed to evaporate from neglect or indifference"[1].

The honour of being the first European to reach Gangotri fell to James Baillie Fraser who was on a visit to his brother William, a Bengal Civilian, assistant to the Resident at Delhi. On the outbreak of the Nepāl War, William Fraser was appointed political officer to Gillespie's force which occupied the Dūn in November 1814 [90]; he was afterwards given political charge of Garhwāl.

In June 1815 James accompanied his brother on a political tour through Narkanda to the Sutlej[2], recrossing into the Jumna valley in July. Whilst William had to return to headquarters, James visited the sources of the Jumna and the Ganges. He writes;

As I had much anxiety to visit *Jumnotri*[3] and *Gangotri*, the sources of the rivers *Jumna* and *Ganges*, ... parting from my brother, who pursued his way to Srinagar, [I] took, with as few attendants as was consistent with prudence, ... the road which leads to the first mentioned place. ...

July 14th [or 15th], we reach *Jumnotri*; ... return and enquire road to *Gangotri*. ...

16th. We left *Cursali* at 6 o'clock, and crossed the Unta Ganga. ... Cross a pass called Ch'haya-ca-Canta; ... descend to a stream called Rindi-gadh. ...

18th. Reach *Durali*...12 coss from *Gangotri*. ...

19th. ... Set off for *Gangotri*. ... Reach *Bhairamghati*[4] at the junction of Bhagirathi and Jahnevi rivers. ...

[Describes Gangotri and inhabitants]. No one seemed in the least to doubt the fact that the river had its rise in the aforesaid hollow of snow. ... The old popular idea, that the *Ganges* issues from a rock like a cow's mouth, ... did not fail to occur to me, and enquiries were made into the origin of this fable. When it was mentioned, the pundit laughed and observed that most of those pilgrims who came from the plains put the same question in several shapes. ... He gravely assured us that no such thing happened, and that the river, in truth, came from the snow as above mentioned. ...

We had now staid the full time we could afford, and had not in fact provisions for another day; preparations were therefore made for our return, and on the morning of July 21st we set off for *Durali*.

23rd. Our perambulator, which had accompanied us through the hills, became so shattered and crazy at *Durali* that we could make no further use of it. ...

29th. ... Reached *Dehra*. Next morning we left the *Dun* by the *Kearu* Pass, and reached Saharunpore on the night of the 30th of July[5].

Fraser was no surveyor, and makes no mention of any instrument other than the perambulator. He produced, however, a rough map which was published with his journal in *Asiatic Researches*[6]. Like Webb he failed to realise that the upper Bhāgīrathi above Gangotri is fed from the drainage of the northern slopes of Badrīnāth, Kedārnāth, and Srikanta, and that the Jāhnavi, or western branch, rises 30 miles north of the main range of snowy peaks [77].

LAKE MĀNASAROWAR

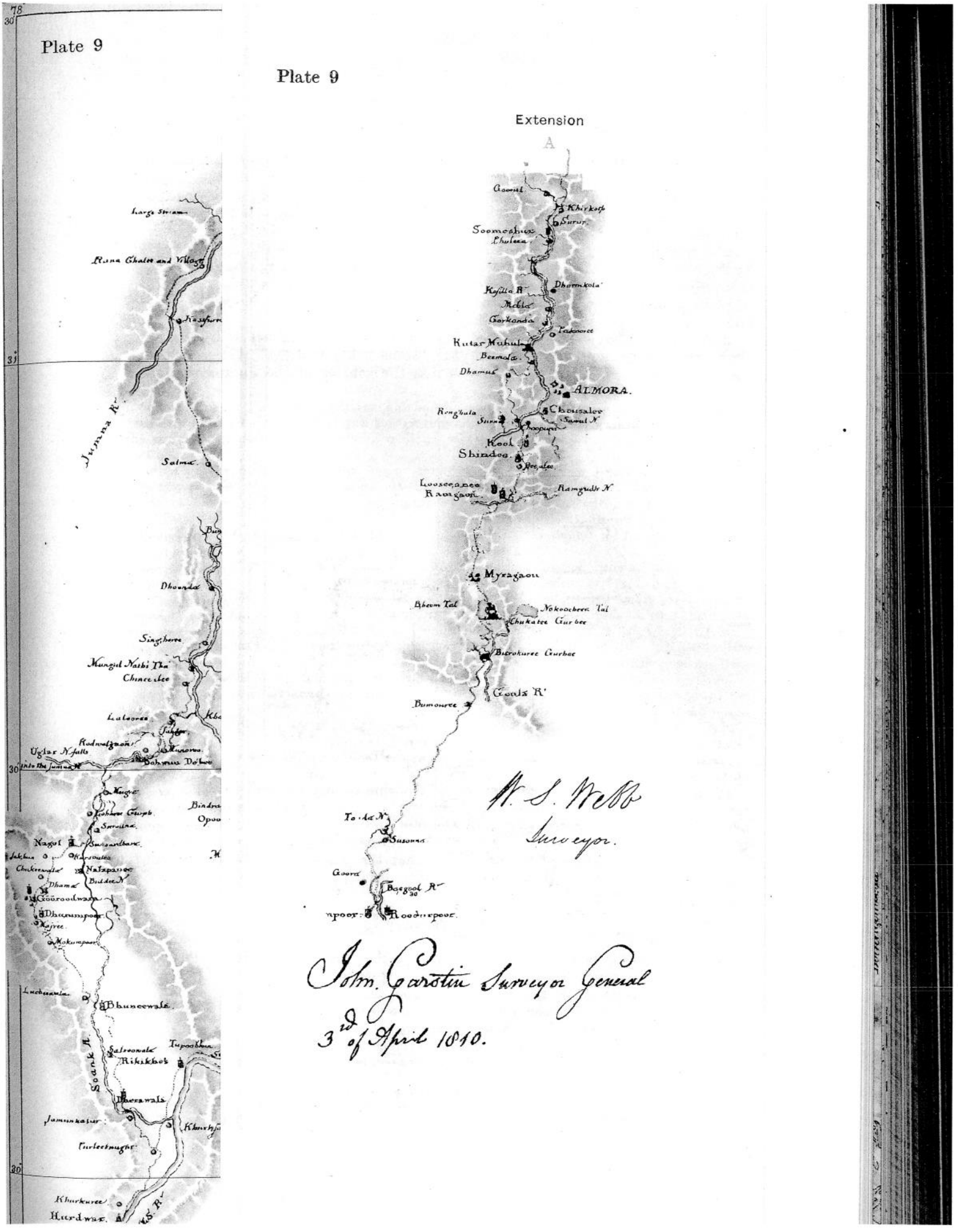
Linked with legends of the source of the Ganges was the romance of the twin lakes Mānasarowar and Rakas, or Lanka Dhe, to which references are found in the earliest writings about Himālayan geography, and which were declared by one authority or another to be the mysterious source of the Ganges, the Gogra, and the Brahmaputra. Wilford tells us that,

According to Puran-gir[7], this lake is situated on an elevated plain covered with long grass, to the north of which is a conical hill called *Kyem-lung*, and dedicated to Maha-Deva; and

[1] to SG., 17–7–14, DDn. 136. [2] visiting Sarāhan, 53 E/14. [3] 53 I/8. [4] 53 I/16. [5] *As. R.* XIII. 1820 (171–249). [6] Reviewed, *Edinburgh*. I. June 1819; & *Qy. Rev.* 24, 1821 (104 *et seq*). Sketch Map, 10 m. to an inch, MRIO. 13 (28). [7] The Hindu *pandit* who accompanied Samuel Turner in 1784 [I, 74 n.6].

Plate 9

Plate 9



which is inserted in the map of the Lamas [I, pl. 7], but without name, and with two roads ending there. It is one of the Southern peaks of Mount *Cantaiseh*, which, rising behind the subordinate peak of *Kyem-lung*, is considered by pilgrims as the source of the Ganges[1]. ...

The lake of *Man-saraur* is mentioned by Pliny. ... M. Polo [I, 70] describes it as to the West of Tibet, but does not mention its name. It is mentioned by P. Monserrat [I, 68]. ... He calls it *Mansaruor*, and from the report of pilgrims places it in thirty degrees of latitude North, and about 350 miles to the North East of Sirhind.

The first *European* who saw it was P. Andrade [I, 68] in the year 1624 ; and in the years 1715 and 1716 it was visited by the missionaries P. Desiderius and Freyre [I, 68–9]. ...

The difference of longitude between Delhi and *Manasarovara* is according to Monserrat 5° 2′. This places Manasarovara in 82° 2′ of longitude, and both its longitude and latitude are remarkably correct ; but what is more surprising, the good father was ignorant that the *Ganges* is sued from it [73, 74][2].

We have recorded the account of the lake given by Father Tieffenthaler [I, 72] ; Colebrooke notes in his fieldbook that ;

Dr. Gillman[3] at Bareilly informs me that the lake of Munsaroar, from which the Ganges and Sarjoo Rivers have been supposed to rise, is usually frozen over in the winter, and that the merchants and other Travellers proceeding to Yarcund frequently cross it on the ice ; that about 2 years ago a dreadful catastrophe happened by the breaking of the ice, when six hundred people who were crossing over the lake perished in a few minutes. This account he says may be depended upon, as he had it from a respectable merchant now at Moradabad, who carries on a continual trade with Tibet, Cashmere, & Yarcund[4].

After his expedition up the Ganges in 1808, Webb asked that he might be allowed to visit the lake ;

Adverting to the entire deficiency of Geographical and local knowledge of the Transalpine Countries beyond the Himaleea, ... I beg leave to submit...whether a Journey in that direction would not be acceptable as useful. ...

The journey should be commenced in the latter end of April 1810, and the Route which appears most eligible is to cross the Snowy Range by the Tugla-Koth Ghattee[5], distant from Almora sixteen days journey in a N.E'ly direction. After visiting the Lakes Mansurwar and Rawun (near Tugla-Koth), to proceed thence across the level country beyond the Himaleea... as far westward as Luthee, returning to the Garhwal by that Ghattee[6] about the beginning of September, when the Frosts commence, and eventually to the Plains as far West as the Jumna. ...

To give this Tour a chance of being as widely beneficial as possible, I should be happy if it were included in my Instructions to endeavour to ascertain the practicability of obtaining Fir Spars and other Marine Stores from the Hills, as on my return to Ghurwal in September the season would be favourable for such experiment[7].

This suggestion was supported by the Surveyor General ;

Our Geographical researches and Knowledge of the Countries beyond the Himalia Mountains entirely depend on the hearsay evidence drawn from the report, said to be made by the Chinese Surveyors, whose account of the Source of the Ganges which they say were sent purposely to explore, being found untrue, throws doubt upon all the rest of their Narrative [I, 70–1][8].

On being asked to furnish further details, Garstin replied ;

From the information of an intelligent native in his employ, who has visited the places whose exact situation are to be ascertained, he [Webb] states "that there are two great Lakes only one of which is laid down in any Map extant, viz. Lake Munsurwar. It is however erroneously placed in our Charts. The other, by far the largest and most important, named Rown Rudh, remains unnoticed. It has several considerable Islands in it, whose lofty Hills are covered with Woods ; both lakes are surrounded by Mountains thro' which several large streams flow".

It is desirable for the improvement of Geography to have their position correctly determined by Astronomical Observations ; to note the points from whence the Rivers issue ; the course they take ; and procure the best information of the neighbouring Countries through which they pass. ...

After much enquiry I have discovered two Gentlemen either of whom are capable of making the drawings that will be required, and willing to undertake to do so, one of them eminently

[1] Kailas, 22, 028 ft. 62 E/8. [2] *As R.* VIII. 1805 (322–8). [3] John Gilman, Surg. Ben.; ed. Barts.; Ens. Bo. Inf. 1781; Asst. Surg., with Pearse, 1782 ; Surg. 1795, with Dinapore Divn. 1816 ; ret. 1824; d. Cheltenham 1830. Crawford I (237). [4] MRIO. M 533, Jan. 1808. [5] Taklakot Pass, 62 F/3. [6] Possibly Niti Pass, 53 N/13. [7] DDn. 82 (124), 19–4–09. [8] ib. 81 (95), 13–5–09.

qualified ; and Lieut. Webb notes that Capt. Lieutenant Raper, who was of the party to Gungoutree, and kept the Journal, is willing again to accompany him if employed[1]. Sanction for Webb's expedition could not be obtained from Nepāl.

Before describing Moorcroft's successful visit made two years later, we may note the following account collected by Hodgson ;

Rout of Beiknarain, a Bramin on a Pilgrimage from Falour, Latitude 31°, to the Mannsur Lake, and thence by Luddack, Argund & Jumboo[2], back to Falour, which is on the North bank of the Sutlej River from Ludiana.

[Gives description of places and rivers passed ; distances estimated in Koss, and bearings by principal points of compass].

Mannsoar Lake is described as being 2 Coss from North to South, and 1½ from East to West. High grass or reeds to its north and north-east sides. A temple on south-east side belongs to the Lama Gourou. The narrator is ignorant of any river issuing from this lake, but it is most probable that it is drained by some streams. He did not go round it, or to its east side, his purpose being to bathe, & I fancy he is quite ignorant of the size or shape of the lake[3].

In 1811 William Moorcroft, Superintendent of the Company's stud at Pusa[4], wrote to the Governor General's Agent at Fatehgarh on the subject of horse-breeding, and proposed a "journey into the Hills" with a view to bringing back

new blood from the Hill strains ; also the Goats bred for the sake of their Long Hair. ... I shall proceed upon the regular line of route of the Pilgrims to Joshumut [75], eleven days' journey, thence quitting this road under the plea of going to the holy Lake of Munsurwar, I shall skirt the Dowle Gunga, the large Eastern branch of the Aluknundar, in my way to Mullanee, a pretty large village under the Government of the Gorkahs.

The A.G.G. gave permission for Moorcroft, with Hearsey as companion, "to penetrate into Tartary", but Government was most disturbed to hear of it, and though too late to stop Moorcroft said that they would have been

strongly disinclined to sanction a project so replete with danger to himself and his companions, and so little likely to be productive of advantage to the public Service[5].

Travelling in disguise, Moorcroft and Hearsey left Ramnagar in May 1812, followed the Rāmganga to its source, and dropped down to the Alaknanda at Karnaprayāg ; then up that river and the Dauli, and over the Niti Pass into Hundes beyond the snowy range. They reached Gartope on July 16th and, passing through Gartok, went on to the Mānasarowar Lake.

On their return they followed the Sutlej for a few marches westward, recrossed the Niti Pass and then, like Webb in 1808, were held up by the Gurkhas in Kumaun, and had the greatest difficulty in getting away [75]. They finally reached India safely in November, bringing back large herds of long-haired goats, which Moorcroft regarded as far the most important results of the journey[6].

A rough survey was kept up the geographical results were most interesting ;

May 26th. At Joshi-Math we left the road to Bhadrinath. ... The principal part of the minutes of our route is taken from the notebook of Mr. Hearsay, who carried the compass and brought up the rear, accompanied by Harkh Dev [who]...was directed to stride the whole of the road at paces equal to 4 feet each[7].

This latter statement greatly puzzled Colebrooke and the *Quarterly Review*[8], but the simple explanation is given by Gerard ; the Indian pace is recorded each time the left foot comes to the ground, so the *pandit* did not have to stretch himself uncomfortably[9].

Halting on the bank of Mānasarowar, Moorcroft writes, on August 6th ;

Hindu geographers have derived the *Ganges*, the Satrudra, and the Kali or Gogra, from this lake ; and, as I believe no *Europeans* ever before visited it, I was anxious to ascertain whether it really gave rise to the two last-mentioned rivers or not. As to the former, it is quite clear from the observations made in this journey, coupled with those...by Messrs Raper, Webb, and Hearsay, that the *Ganges* derives its supplies from the melted snow of the mountains of the *Himalaya*, and a thousand small streams which fall into its various

[1] BMC. 3–10–09. [2] Phillaur, 44 M/16 ; Ladākh, 52 B, F, G ; Jammu, 43 L/14. [3] Note by Hodgson, Nov. 1813. MRIO. M. 347. [4] 72 G/9. [5] B Pol C. 25–6–12 (63). [6] Journal, *As R.* XII. 1818 (380–533). [7] ib. (382). [8] *Qy Rev.* XVII. 1817, (403). [9] *Koonawur* [137n.]

branches during their passage from those stupendous rocks to the great common mouth at *Hardwar*; and that it does not receive the smallest streamlet from the extreme Northern face, nor from a source to the Northward of them [77, 79][1].

He walked for some distance along the northern shore of the lake, and sent reliable men "beyond the south-west corner, ... without finding any appearance of a river issuing from the lake, or of any former bed of a river".

A severe attack of fever prevented him from visiting the second lake, "Rawanhrad", or Rankas, to the west, but on 8th August he writes; "I think I saw a stream issue out of it at the western side, ...which probably communicates with the many streams which form the Setlej", on which Hodgson comments;

There is a story, & indeed I heard Mr. Hearsay & Mr. Moorcroft affirm it to be the case, that they saw the Sutleez issue from a lake which they call the Maunsoroar[2]; when I heard this I gave no credit to it, thinking it impossible that a river, smaller at Ludianah than the Jumna at Delhi, could have so long a course in a mountain country & be no bigger; however, if it does send off so great a branch as the Tonse [83], it may be so.

At Hurdwar I expect to get a sketch of Mr. Hearsay's route; neither he nor Mr. Moorcroft are astronomers I believe, tho' they had I understand a pocket compass[3].

The Surveyor General replied;

Mr. Moorcroft makes the Sutluj rise out of a large lake called Rawun Rud, close and to the Westward of the Munsurwar Lake, round the half which Mr. M. went, and found neither inlet or outlet. The Indus he draws from a Source lying N. 40 (G.M.) W. of Rawun Rud, commencing from rills running down the Northern side of a range of Mountains he calls the Kylass range, from that being the name of a very remarkable high snowy peak in that neighbourhood, ... but I suppose by this time you have seen Mr. Hearsay's sketch, which I make no doubt will be the same as the one of his now in the office, copying out by order of Government[4].

Hearsey's original map, with his signature, is preserved in seven sections, scale two miles to an inch, and a reduction on the scale of 10 miles to an inch appears as frontispiece, headed *Plan of a Tour to Chinese Tartary*, to Moorcroft's account in *Asiatic Researches*[5].

THE DŪN, GARHWĀL, & SIRMŪR, 1813–4

Except for pilgrimages to the sacred places, the people of the plains had but little concern or intercourse with the hills, and the following is the best account that White could give when he viewed Sirmūr from north of Ambāla in 1809;

The hills, of which there are several ranges, are covered with brushwood, Bamboo, and the high grass jungul, and during the night fires are frequently observed, occasioned either by the friction of the Bamboos against each other, or the scintillation from the stones rolling down the hill setting fire to the grass jungle; the Hills rise gradually above one another: the distance of one of them, apparently in the last range, from my Tent...was 18½ miles, and its height upwards of 1,900 yards, the Natives say 6 kos. The Snowy Hills are further & higher.

Iron and lead, a small quantity of Copper, and a little Gold, is procured from these hills. Elephants, Bears, Wolves, & Tigers, inhabit them, but no Lions, from whence it is conjectured those seen at Patialah must have come from the South.

The Forts of Moona, Dillouh, & Tuksal, situated in the Hills, are discernable at a considerable distance. They belong to Pergunnah Nahan, which is in some degree dependant on the Gorka raj. The vallies between the Hills, being supplied with Water by a number of Springs, produce rice & wheat of a very superior quality, and have several Topes of Mangoe, Seesul, and other large Timber[6] [86].

Though White was able to fix the position of Nāhan [63] he was not able to extend his survey into Sirmūr, which the Gurkhas occupied during 1810, extending from the Dūn and Garhwāl. As warden of the frontier Ochterlony viewed this advance with suspicion, and forwarded to Government copies of his correspondence

[1] *As R.* XII. 1818 (467 *et seq*). [2] cf. Tieffenthaler [I. 72]. [3] to SG., 29–3–14; DDn. 136. [4] SG. to Hodgson, 11–5–14; DDn.135 (41). [5] MRIO. 91 (18–24) with very neat lettering and pen-and-ink sketche, of peaks; 91 (20) shows "summit and appearance of the Mt called Kylass, the highest of this range, covered with snow [I. 71]"; reduction 6 m. to an inch, ib. 91 (15); see also compilation ib. 10 (23). [6] DDn. 82 (174), 28–5–09 *Seesul*, probably *Shisham*, or *Dalbergia Sissoo*, rather than *Sisal* or *Agave*.

with Amar Singh Thappa, the Gurkha commander in the hills, but was very vague about the places mentioned ;

Groping in the dark as I am compelled to do, not only by our limited knowledge of the geography of this country, but by being liable to deception whenever interest may be supposed to require falsehood, I trust I shall be excused for giving the description and site of the different places mentioned in them in nearly the same words as I received them[1].

The following month he sent

a sketch of my route through what is called the valley of Punjor, from Munny Majra to Roper, ... which I trust will prove...that the claims of the Gorkha Commander are inadmissable and ought to be resisted [90].

The Governor General in Council saw "no good in asking the Government of Nepal to relinquish their conquests"[2].

Surveyors had managed to penetrate into the Dūn in spite of Gurkha occupation. Gacoin had surveyed the Jumna to a point 30 miles beyond the Siwaliks [58], and in 1811 Blake

proceeded with Mr. Rutherford, the Agent for Timbers, beyond the Dhoon Valley to the Thibit Mountains, which enabled me to annex this hitherto unexplored Country to my former Survey [36][3].

We hear more of Rutherford from Hodgson who in 1813 was working as assistant to White in the upper *doāb* [37], and was most anxious to extend work into the hills ; he writes from Morādābād ;

From Conversation I have had with the Civil Officers here, & more particularly with Dr. Rutherford, the Agent for Timbers, ... it would appear that much uncertainty prevails as to the limits of our Territory on the Frontiers of this & the Bareilly Province under the Hills, & I hear the Frontier is so little defined as to give rise to continued disputes with the Hill Chiefs, and it appears now an object of Importance to define these limits on which...grow those valuable Forests, which now by Dr. Rutherford's exertions supply the whole of the unwrought Timbers for the Artillery ; great Quantities of Hemp and other valuable articles.

Mr. Rutherford's concerns obliging him to traverse all parts of the Northern frontiers, & the Hills & Vallies beyond it, he is probably better informed on all subjects connected with their Resources...than any other person, & will willingly furnish Information very valuable to any Surveyor, were it thought proper that the Province of Rohilcund should be surveyed. ...

Were I allowed to accompany him in his Annual Round to the Forests after the Rains, I think I should be able to lay down a good deal of the Frontier, & some of the places within the Mountains, within which many Gentlemen have at different times gone, & some Sketches have been made & cursory Surveys, ... but as I cannot learn that they took Daily Observations of Latitude, or occasional ones of Longitude, without which, & well observed Bearings, I presume little can be done in Surveys in Mountainous Countries or Forests, probably there is much room for improvement in what little has been done, & ample Field to do more[4].

He writes again ;

14th November. ... I think a Month or 6 weeks will finish this portion of Country up to Hurdwar & then I purpose, if you approve, of entering the Hills at the Jumna & going to Dera, a large Town where the Aumil of the Nepaul Rajah resides ; he is very accommodating, & I think he will let me pass between the 1st & 2nd Ranges, or Doon, to Hurdwar ; of course I will make him presents & make as little parade of Surveying as possible, using the Pedometer, Latitudes, & a few Bearings by the Compass.

I wish indeed to be on good Terms with this Aumil, ... hoping about March, when the Weather suits, to be able by their assistance to reach the Source of the Ganges which Lt. Webb was prevented doing [74–5][5].

9th January 1814. ... Having finished the Survey of the Low Lands I turned to the North again, & having met Mr. Rutherford have been tempted to avail myself of the opportunity of taking a slight Inspection of part of the Doon Valley, to Laker Ghaut and Rikikeis[6] &, if I can, of Deoprag where the Bagrethi and Alukindra rivers join ; I then propose to return to Hardwar, & proceed along the foot of the Hills to Padshamahal, & if I have a good opportunity hope to be able to go to Calsie[7], & take a look at the upper part of the Jumna ; ... In my little trip in the Valley I will so order matters as to give no suspicion of surveying. Indeed I believe

[1] *Ludhiana Rec.* (197), 5–4–10. [2] ib. 3–5–10 (222), 9–5–10; another sketch of similar route, Nov. 1813, MRIO. 13 (2, 3). [3] Thomas Rutherford, Asst. Surg. Bengal, 23–3–05 ; ret. 12–1–25. BMC. 4–6–14 (94). [4] DDn. 130 (37), 18–7–13. [5] ib. (97). [6] 53 J/8. [7] Kālsi, 53 F/14.

no obstruction is likely to arise, as several Gentlemen have lately passed through the Doon & met with Civility[1] [pls. 3, 10].

6th February. ... Having taken another line in the Saharanpoor district, I yesterday again entered the Doon, and procured hill carriage, meaning to go from Rikikeis to Deoprag, about 26 or 30 coss of mountain road along the course of the Ganges, but I find the snow is middle deep on the hills I must pass, and as Mr. Rutherford who is to accompany me is not quite ready, ... I am about to take a 10 days run through the Kass Rao pass[2], which is said to be passable for Artillery. ...

I have been at some expense and pains in cultivating a good understanding with the Gurkalie chiefs, and may now lay down the principal positions in their districts without interruption. When I have surveyed the path from Rikikeis to Deoprag my survey will fall in with Lt. Webb's route, and we shall have the whole course of the Ganges. The route is very mountainous and difficult, and cannot be measured by a wheel, but with bearings, latitudes, times, and estimated distances, and the longitude of Deoprag I trust I shall do pretty well. I have used a pedometer, but do not find it to be depended on in hills, owing to the inequality of steps among the rocks, and its getting out of order, but by latitudes and fixed points in view, I get the horizontal distance very well, but I wish I had a couple of barometers for altitudes.

I mean also to look at the upper part of the Jumna, Calsie, Nahan, and will get a general knowledge of this country ; I hope you will have no objection to my so doing, as having so good an opportunity I should be sorry to lose it ; and I find that I can get on better by appearing to be only travelling for my own amusement, than I had formal letters from Government to the Chiefs, as then they suspect some design[3].

Saharanpur, March 9th. ... I have been impeded & harassed by the late rainy Weather, the violence & continuance of which has been unprecedented, ...since the 20th of January until 2 days ago. ... Kadji Rungour, a considerable Chief of the Nepaul Governt. is appointed to the Government of the Doon & of Nahan &c. I will endeavour to obtain his sanction to go thro' such parts of the Mountains & courses of the Rivers as may seem least known[4].

Camp at Timly[5] in the Doon. March 29th. ... At the time of the 2nd Trip I made into the Doon I found the Goorka Commander at Guroo Duara was jealous of my operations & he behaved insolently. ... I wrote to Kadji Runjour, the Chief at Nahan, under whom the Deyrah man is employed, telling him I was going into the Doon to shoot, &c. ; also I wrote to the Deyra man & sent to tell him that he need not be alarmed by my Perambulator, as I should use none, as I was only going to shoot Tygers, & that I should visit him at Deyrah.

I then entered the Valley by this pass (Timly) 10 days ago ; I went to Deyrah, but the man would not visit me nor give me guides or protection to any place except Hurdwar ; however, having received a friendly letter from his Superior, the Kadji, I disregarded him, except so far as related to going across the Jumna to Calsie. I set out up the Valley for the Budrajh Mountain[6], round which the Jumna flows into the Doon.

I laid aside the Wheel from the first & conducted my operations as snugly as possible ; taking daily latitudes, Longitudes, &c., & with these, estimated Distances, Bearings roughly taken on the road and checked by accurate ones of a fixed point, ... I shall be able to make a good Construction.

He had a stiff climb to Bhadrāj but was disappointed to find the snowy range hidden in cloud, though he got a latitude and a good view of the immediate neighbourhood ;

The Tonse[7]...by the telescope appeared treble the size of the Jumna. ... Of this remarkable & yet unnoticed River all the accounts I can gain are that it branches from the Suttleez, or Sutrud ! [81] but where, I can gain nothing like good information as yet ; to determine this very curious point I am eager, & will go as far as I can in that Direction if the Gorkalies will let me[8].

For some weeks of March and April Hodgson had the company of Colin Mackenzie [78], Lady Hood[9], and Ezekiel Barton. He then worked up into the hills of Sirmūr till the middle of May when he returned to Sahāranpur to finish off the survey of the *doāb*, writing on 28th May ;

Here there is nothing to do or to detain me ; the minute part of the Survey is nearly finished ;

[1] DDn 130 (133). [2] 53 J/4. [3] DDn. 130 (161). [4] ib. 136 (1). [5] 53 F/11. [6] 7320 ft., 53 F/15. [7] Tons R., risse 53 I/8. [8] DDn. 136 (3). [9] Dau. of Francis Humberstone Mackenzie, cr. Lord Seaforth 1797 ; m. Adm. Hood, C-in-C. EI. Squadron, who d. Madras, 24–12–14. Account of Lady Hood, settled in Stornaway, and remarried as Mrs. Stewart Mackenzie, *Reminiscences* (350).

I am only filling up some less completed spaces in the Map, tho' indeed I can hardly find room to put in all I have, ... and since I have completed the East side of the Upper Doab, and on the interesting parts, the Mountains & River heads, nothing can be done before March [1815]; in the rains the Torrents prevent all access, & in the cold Weather, the Snow.

Had not the Disputes towards Gorackpour taken place [38–9], I should ere this have been at Gangoutri [77–8][1].

He closed down field work in June[2]; "The hot winds which are violent, & the atmosphere darkened by dust, prevent any observations at present"[3].

Both Hodgson and Mackenzie had been pressing on the Surveyor General the possibility of a general survey of the Himālayan region [88–9], and Crawford himself was interested. He suggested to Government the resumption of the continuous survey of the northern frontier which he had started in 1804–5 [6, 27, 71];

In laying down the Rivers that flow into Hindoostan from our Northern Boundary (to enable me to finish and complete the great General Map), particularly the Teestah, Coosy, Gunduck, Raptee, and Gogra, I have been [met] with a great deal of Contradictory matter ; so much so as to induce me to wish that these Rivers were more accurately defined, and the Latitudes and Longitudes of the different Towns of note on their banks were once for all laid down with precision.

The Gogra was Surveyed during the late Colonel Colebrooke's last trip, to which his life fell a sacrifice ; by his public letters in the Office I find he certainly did survey that River, but since his death the Papers relative to that valuable work must have been lost, as they have never been forthcoming [29–30, 33].[4]

Crawford goes on to suggest that he should carry out this survey himself, travelling by river ;

The very great advantage obtained by going to the different points by water arises from being able to carry my own collection of mathematical and astronomical Instruments, joined to those of the Company's (forming together by much the most perfect set of Instruments that were ever used in this Country), as they are [too] numerous, ponderous, and delicate, to bear land transportation, and by having these valuable instruments with me I would be enabled to obtain an object much desired in science ; that is, the distances and altitudes of the Snowy Mountains. ...

In February 1812, I solicited permission of Lord Minto to go to the top of these Rivers merely to obtain the distance, exact position, and altitudes of these mountains, which his Lordship was kindly pleased to grant, ... and I was actually proceeding on my way to commence, when I was overtaken by an Order to go on the Survey of the Southern Frontier [45][5].

Government agreed to the survey, but considered the Surveyor General's absence from " the Presidency would be attended with inconvenience and detriment to the Public Service "[6]. The job was offered to Hodgson, who accepted with delight ;

The Survey in question is what of all things I most wished for, and your nomination of me to it will oblige, flatter, & honor me in the highest Degree, & I will be in readiness to set by Water for Calcutta by the end of next month[7].

On his way down to Calcutta in August, he found preparations in full swing for war against Nepāl, and copies of his surveys of the Dūn in eager demand [pl. 10]. He was himself appointed Surveyor to the column which advanced from Dinapore [41–2], and the following summer was appointed to make

a correct Survey of the lately liberated provinces of Gurawal, Sirmoor and Hindoor[8], as well as of the countries to the north of them, reaching to the Himalehah ; a tract which comprizes the Sources of the Ganges, Jumna, Tonse, (hitherto unknown though larger than the Jumna) and Setledge rivers, and which is bounded by some of the noblest Mountains in the world[9].

An account of this survey must be left to a later volume.

THE SNOWY RANGE

We have noted the amazement with which early residents and travellers gazed

[1] DDn. 136 (60). [2] Maps, MRIO. 10 (9), 15 (31), 16 (19), 17 (46). [3] MRIO. M 347. [4] A temporary mishap ; the fdbks. are extant as DDn. 74, 75, 80, and MRIO. 73, M 468–70, 474. [5] BMC. 12–3–14 (65). [6] ib. (66). [7] DDn. 136, 28–5–14. [8] Hill State west of Sirmūr. [9] BMC. 17–10–15 (54).

on the snow-covered Himālayan range as seen from the dusty plains of Hindustān, and we have recorded the first efforts to determine the distance and height of individual peaks [I, 76–7]. We now come to the work of trained surveyors, encouraged and directed by the Surveyor General, Robert Colebrooke, of whom his cousin Henry writes ;

Colonel Colebrooke's notice was also drawn to the subject by the communications of Dr. Francis Buchanan and Lieutenant Colonel Crawford, who both visited *Nepal* in 1802 [70–1], and who were convinced...that the sources of the Ganges are on the southern face of the Himalaya [77, 78], and that these mountains are of vast height. He had likewise knowledge of a survey by Lieutenant Colonel Crawford, executed in 1805 along the northern frontier from *Behar* to *Rohilkhand* [27], in which bearings were taken of every remarkable peak of the snowy range which could be seen from more than one station ; and consequently the distance of those peaks from the places of observations...were determined[1]. ... Colonel Crawford had also taken altitudes, from which the height of the mountains might be computed, and which gave, after due allowance for refraction, the elevation of conspicuous peaks. ... But the journal and drawings of this survey have been unfortunately lost. ...

Colonel Crawford, during a long sojourn at Cat'hmandu in 1802, took the angles of several selected points, of which he determined the distances by trigonometrical measurement. ... The positions of the same mountains were also settled by observations of them made from the plains of *Behar* in the progress of the great survey which has been mentioned[2].

A list of Crawford's Nepāl observations was published by Buchanan, and includes observations made from "Dhaybung" to eight peaks on 26th October 1802, 3 p.m. ;

Double altitudes observed by Sextant—allowances for refraction—bearing—computed distance—Height by Trigonometry—additional height for curvature of Earth—Result, 11,000 to 20,000 ft. above stations of observation[3].

Plates II to VII at the end of Buchanan's book give views taken in Nepāl, with profiles of the snowy range, distinguishing the peaks observed [71] and these observations were referred to in 1855 by Andrew Waugh, Surveyor General, when investigating the heights of the newly fixed Mount Everest and other peaks ;

I have been led to this topic by laying hands on some old memoranda, sketches and drawings which I had collected some 5 or 6 years ago. Among these memoranda I find some notes and a sketch of part of the Nepal Mountains given by Crawford. ... I should like to have Crawford's book to establish these identities satisfactorily. I should like also to see Turner's Embassy to Thibet [I, 74]. ... As the identification of our points with those observed by former Surveyors, or mentioned by former writers, will be interesting, any other information which may conduce to establish a comparison will be valuable[4].

In a description of Sikkim dated November 1814, Buchanan has left one of the earliest known references to Darjeeling ;

On the north is the snowy ridge of Emodus [I, 67, 220 ; II, pl. 2] separating Siccim from Lassa, penetrated by three rivers. The Kan Kayi on the west...runs into a narrow valley which belonged to Siccim, and in which are two golas or marts, Bilasi and Maghaya. ... The Kanki, further down, divides the Kirats and Siccim, till it reaches the plain which belonged to Vijaypur, as far as the Mahananda. ... The two branches of the Teista include the greater part of Siccim.

One day's journey north from Saondrug and Satung is Darjiling, the principal station of the Goorka troops, six days from the capital, and twelve from the Snowy Mountains.

Siccim is on the west of the Jhami Ruma, which rises from the south side of the snowy range and divides into two branches opposite the town, which surround an immense mountain on which is a stronghold named Tasiding. ... Some way below, the Raman joins from the west from mountains on the Kan Kayi ; united they form the Rimi Kma, which soon joins the Teista[5].

Crawford's survey from Purnea to Rohilkhand in 1805 was not so extensive as that which Colebrooke had proposed [71] ;

My idea is that it should be carried along the whole of the Northern Frontier, commencing or terminating at Rungamutty or Doobary[6] on the Burrampooter, ... and that it should

[1] See also Crawford's own statement, DDn. 131 (57), 11–5–14. [2] *As R.* XII. 18 (25 187–62). [3] Hamilton (346). [4] to Thuillier, 18–12–55 ; DDn. 665 (157) "Crawford's book" is not forthcoming ; Buchanan's book was pubd. under his later name of Hamilton. [5] BSC. 27–12–14 (268). [6] Dhubri, 78 F/16.

reach as far as where the Jumna enters the Plain above Saharunpoor. This Part of it would employ you at least six months, and would enable you to ascertain by Trigonometry the Position of all the principal Peaks in the Himaleh Range throughout a space of 900 miles.

The most arduous part of the undertaking, however, must be that part of the Survey which would carry you to a Region of intense cold, and where Dr. Buchanan says Travellers can only go during the periodical rains, when the Snows are melted. But some difficulties must naturally be expected in attempting to penetrate to places where no European has ever been before. ...

Probably the Rajah of Srinagur, when persuaded that you had no other object in view but to gratify the world with an account of these wonderful Places, would materially assist you[1].

The survey was broken off by an invasion of Rohilkhand, of which Thorn gives a stirring account. In February 1805 whilst the siege of Bharatpur was in progress, the *pindāri* chief, Amīr Khān, [49] invaded the *doāb* and Rohilkhand. Before he could be overtaken by the British cavalry sent in pursuit, he had been held off from Morādābād by the gallant defence put up by the Collector, William Leycester, and also from the fort of Putturgurh, where the defence was led by Crawford[2]. Thorn describes his personal impressions of the mountains as seen by the pursuing force when they reached Pilibhit[3];

These two mornings exhibited a spectacle, which in sublimity and beauty surpassed all power of description, and to do which even the pencil of Claude[4] would have been incapable of doing justice.

The grey mist of the dawn was deepened in our front by the shadows of the mountains of Kemaon, over which arose the sun in magnificent splendour, spreading a broad stream of light that gave a delightful effect to the varieties of the surrounding scenery.

Directly before us, at the distance of thirty or forty miles, was a range of hills, rich in verdure, and covered to their summits with stately forests of saul, sissoo, and fir trees; while far beyond towered high above the clouds the gigantic Himalaya mountains, their heads crowned with eternal snow, and glittering with the effulgence of the solar beams playing on the immense glaciers of those unexplored regions.

According to observations made by Colonel Colebrooke at Pillebeet and Juthpoor[5], the height of one peak in the Himalaya range distant from the former place one hundred and fourteen, and from the latter ninety, miles, was...20,308 feet, allowing for refraction at the same rate as for celestial objects. But by allowing one eighth of the intercepted arc for terrestial refraction only, the result gave a height approximating to 22,000 feet, in round numbers; or, with a still greater reduction of allowance for the elevation above the plains or Rohilcund, the height would be 22,291 feet; which is nearly equivalent to 22,800 feet above the level of the sea[6].

Colebrooke's observations are thus described in his fieldbooks and journals [29–32];

Near Gorackpur, July 28th, 1807. The weather was clear, and the whole range of snowy mountains was visible, and presented a scene which for grandeur can scarcely be rivalled. These mountains are without doubt equal, if not superior, in elevation to the Corderillas of South America, and if it should appear that the latter is the case, they must consequently be the highest mountains in the known world.

August 1st. Went on shore early and walked in the village of Kerminee. ... As I approached the village, I was on a sudden struck with the grandest view of the Snowy Mountains which I had ever had before. I immediately put up my theodolite to observe them, and obtained the following bearings of the principal peaks, as delineated below[7]. ...

It is remarkable that every part of the stupendous range of mountains appeared to be entirely covered with snow, so as in most parts to be inaccessible. Such being the case, as their latitude scarcely exceeds the 29th degree, and the time I observed them was nearly as hot as any in the year, it is probable that the very lowest part of the mountains that was visible could not be less in height than 14,000 feet, which is height at which snow is supposed to lay without melting in tropical climates. ...

The curvature of the earth in a distance of one hundred miles, which is the least at which I observed them, gives nearly as many feet for the depression of the lower parts, or bases, of

[1] DDn. 67 (506), 5–5–04. [2] BSC. 16–5–05; Crawford's protractions, MRIO. 30 (32, 91–9); 30 (99) shows intersecting rays to snow peaks from Nāthpur to Bulrāmpur, long. 82°, and also from Patna and Monghyr; 30 (91) shows Putturghur Fort, 3. m. E. of Najibābād. [3] 53 P/14. [4] Claude of Lorraine (1600–84). [5] Original computations at end of Fdbk. DDn. 73. [6] Nanda Devi, 25,640 ft.; Trisul, 23,360 ft.; 110 m. due N. of Pīlībhīt which is 500, ft. above sea. Thorn (436–7). [7] in several neat profile sketches.

these mountains below the horizon. It follows of course that all which was visible above the horizon is addition to what remained below.

The elevation of two of the peaks as taken by the vertical arch of the instrument at several observations was 3° 5′ nearly, from which, however, must be subtracted the refraction, but I had no means of ascertaining the quantity of it at this time. ... If the refraction be taken from the common refraction table, viz. 4° 20′, the angle of elevation will be reduced to 2° 50′ 40″. If we take then a base of 100 miles, the perpendicular which is subtended by this angle will give about 4 miles in perpendicular height, but it is probable that the refraction may be greater than what the table gives. To this must be added 6,600 feet, which, supposing the distance not to be greater than I have stated it at, gives 1 mile and 100 yards more.

Two of these mountains will therefore be more than five miles in perpendicular height above the level of the plain on which I stood, which must be considerably elevated above the level of the sea. ...

I must for the present postpone any further remarks or calculations until I can compare my observations with those of Major Crawford, who observed the same mountains in Nepal, and with the observations which have been made of the Andes in South America, and of the Peak of Teneriffe, which last has been hitherto thought to be the highest land in the ancient hemisphere, and I trust that I shall then be able to prove that the mountains of Tibet are not only higher than any in the ancient hemisphere, but also in the known world.

As I was observing the snowy mountains this morning, the villagers of Kermeinee came out out to gaze at me, and looked at me and my instrument with silent astonishment which I could plainly depict in some of their countenances. Few of them had probably ever seen a European before, and the sight of me and my instrument all at once seemed to be too much for them[1].

The following month he got more observations from the Gogra river some miles above Bahramghāt ;

Sept. 15th. This morning I perceived through the haze of the horizon several of the snowy mountains, of which I immediately took the bearings. The principal mountain bore N. 45½° E. and the others 55½°, 56°, and 61°, to which must be added the variation...east to give their true bearings. The more easterly peaks, which appeared to be connected in one range, I take to be the same which I observed from Goruckpoor and Karmenie.

Again a few miles above Fyzābād ;

Sept. 27th. This morning I had another sight of the snowy mountains, and for greater accuracy took their bearings again from the same spot[2].

He quotes without comment from a journal kept by Dr. Gilman [79] ;

March 26th 1802. Saw 2 Volcanic peaks in the Hymalia Range, from both which smoke evidently issued. ...

29th. This morning had a grand view of the lofty summits of Imaus [pl. 2], and smoke was distinctly seen by the whole party, issuing from one of the peaks seen on the 26th[3].

The explanation of this phenomenon is the plume of fine snow driven by the strong winds off the summit of the peak.

After Colebrooke's death Webb had told the Surveyor General that he would find among

Lt. Colonel Colebrooke's papers several Trigonometrical Calculations for determining the height of some remarkable points in the Himaleea Range, the Stations of observations having been satisfactorily ascertained by Mr. Burrows [32].

In a small red memorandum Book of the Colonel's you will find one of my calculations for the height of a peak, afterwards observed from the village Churung, as far as I know upon correct principles[4].

The heights calculated by Webb after his journey to Badrīnāth were affected by uncertainty of the height of his own position [76]. This consideration did not however affect his observations from the plains during 1809–10, when he observed the position and height of Dhaulāgiri[5] with "bearings from four stations, and altitudes from three", from which Henry Colebrooke calculated a height "at the lowest computation" of 26,862 feet above the sea, a result confirmed within 28 feet by Blake [35][6].

Colebrooke pursued the subject with enthusiasm and, in an article *On the Height*

[1] Journal, DDn. 79, M 532. [2] DDn. 75. [3] Journal, DDn. 73, M 470, towards end of volume. [4] Small red book not now found ; DDn. 82 (46), 23–11–08. [5] 62 P/6 ; height 26,795 ft. [6] Colebrooke (48) ; *As R.* XII 1818 (266–72).

of the Himalaya Mountains,[1] refers to his own early observations at Purnea [I, 77], and continues ;

Not having had the means of completing the inquiry, ... I recommended it to the attention of the late Lieutenant Colonel Colebrooke, by whom it was prosecuted during his survey of *Rohilkhand*, and it has been further pursued to a satisfactory result by his assistant Lieutenant Webb, during his journey towards the sources of the Ganges, and finally during a survey of the province of Gorakhpur [34]. ...

The observations instituted and completed by Lieutenant Colonel Colebrooke, while in Rohilkhand, were two ; one taken at Pilibhit, ... the other at Jet'hpur, where the elevation of the same peak, distant 90 English miles, was observed. ... The result shewed a height approaching to 22,000 feet above the level of the plains of Rohilkhand [86]. ...

Having been furnished with further observations taken by Lieutenant Webb, ... and having compared them, as well as those before made by him and the late Lieutenant Colonel Colebrooke, as with Lieutenant Colonel Crawford's labours in pursuit of the same inquiry, I consider the evidence to be now sufficient to authorize an unreserved declaration of the opinion that the *Himalaya* is the loftiest range of Alpine mountains which has yet been noticed, its most elevated peaks greatly exceeding the highest of the Andes.

A writer in the *Quarterly Review* dealt severely with Colebrooke's article, which he called "a most curious paper". He questioned the reliability of the evidence produced—Crawford's observations in Nepāl depending on triangulation breaking out from a very short base—Robert Colebrooke's observations taken from points whose mutual distances had not been directly measured—and Webb's stations largely dependent on astronomical fixings.

On every consideration, therefore, we conceive we are borne out in concluding that the height of the Himalya Mountains has not yet been determined with sufficient accuracy to assert their superiority over the Corderillas of the Andes[2].

During his survey of Kumaun later on, Webb set himself to extend his observations and to convince the *Quarterly Review* of the truth of his earlier work, but in the meantime interesting observations had been made by Hodgson, who writes from the Dūn in February 1814 ;

Since the 20th ultimo there has been much Rain, which on Hills of the 2nd Range is deep Snow, and above Dera, Rikikeis, &c., they still are clad in it. By the Telescope I judge it to be 2 feet deep at least, but in the Drifts & Valleys much more ; so heavy a fall has not been known for many years.

But on the Himmalya the fall must have been excessive ; the weight of the new Snow brought down the old, & left the bare Rock exposed to my View thro' the Telescope. On a steep part the Snow had slid down, & left the vertical Thickness of the Layer on the Summit exposed to view ; by the Micrometer its Thickness subtended an angle of 40″, the alt. of the Highest Mountain of the range being then 2° 14′ (from Keni, 18 miles N.E. from Seharanpoor).

The vast avalanches which roll down into the Valleys from those Summits sufficiently show that no passage over the Himmalya in the Direction of the Heads of the Great rivers Jumna & Ganges ever was, or will be, effected. ...

If I can find a Post on the 2nd Range to the N.W. of Dera, from whence I can see both the Snowy Peaks & *Hurdwar*, with the 2 Latitudes, & the Longitude of *Hurdwar* & the true Bearings, I shall get a good Base for the Distances & Heights of the Snowy Mountains ; I have taken their Distances & Altitudes from several points in the Survey at considerable Distances from each other ; some of the Altitudes differ 2 or 250 feet, from each other, which may be expected from the varying refraction, the uncertainty of an Instrument graduated only to Minutes, the clearness or otherwise of the Weather, & also one's own Errors in laying down such long distances as between Moradabad, Sookerlal, Seharanpour, & Hurdwar respectively, when they are composed of such a Multitude of small parts as a Road Survey consists of ; however I think the average Height of the highest Peaks is between 21 and 22,000 feet [86][3]

April 1814. ... Mounted to the Summit of Budrajh [83], the Jampuans carried us except in some very steep places. The ascent took us nearly 4 hours. We also got up by the Paharis[4] a small tent. ...

On the 2 days, rain having fallen to the Northward, I was gratified by the sight of the Himalya, extending from 358°, i.e., N 2° West, to 98°. E & F are the 2 peaks of the Great Snowy Mountain of Jamnoutri[5] ; from its vast altitude & comparative proximity the view of

[1] *As R.* XII. (253 *et seq*). [2] *Qy. Rev.* XVII (18). [3] DDn. 130 (161), 6-2-14. [4] hillmen.
[5] Bandarpunch, 20, 720 ft. ; 53 J/9.



SEHARUNPOUR FRONTIER

Reduced from Hodgson's quarter-inch map of 1814.

At the time of his survey through the Dehra Dūn, November 1813 to April 1814, the Gurkhas occupied the whole country north of the Siwālik range, but allowed Hodgson passage, through the Dūn which enabled him to take observations to the snowy peaks from Budrāj hill [82–4, 88–9].

J. C. Hodgson

it was very grand and striking. Eight or ten distinct ranges of mountains, the further of them tipped yet with snow, were between us & the Jumnoutri, & over them it reared its gigantic front, every part being resplendent with the pure snow, but appearing of different tints according to the Sun's position[1].

Mackenzie, who joined Hodgson on this trip, was most enthusiastic about his views of the peaks, and plans for closer exploration [84];

Having got up into the valley extending between the Jumna & Ganges behind the first ridge of hills, I then for the first time had an opportunity of viewing some part of the Great Snowy Ridge, & you may suppose the sight was sufficiently interesting to me, & my wishes were naturally excited towards a further knowledge of that curious tract.

I apprehend, from the clear & distinct view of the ribs & cavities of their sides, that the third ridge is not so very distant as supposed generally from the first; consequently the space occupied by their prodigious excavated hollows, which separate the several ridges cannot be so very wide, as laid down in Arrowsmith's map; yet it is likely that a very considerable belt of wild & rough country exists between this part of India & Tartary; the wildness of it may be conceived from the little intercourse between the inhabitants on either side; yet I am convinced that British Enterprize would surmount the difficulty if encouraged & supported by the immediate sanction of Government[2].

During the advance of General Marley's column from Dinapore towards the Nepāl frontier [41–2], Hodgson had occasional opportunities of observing the peaks, and he writes to Crawford in December 1814;

The weather is very thick & I have only had one fair sight of the snowy peaks, but I recognized several of your old acquaintances, & long to be free from this duty with the troops, & at liberty to choose good positions for operations respecting them & other matters of interest[3],

and, in fact, his main sentiment about the war was to "get the Goorkhas driven back across the Gogra, & have a clear road to the Snowy Mountains in future"[4].

He writes in his journal, February 1815;

The country is low and there are no buildings of any Kind, so that a flag of portable dimensions cannot be seen at more than 4½ to 5 miles, nor will it ever be possible to take distances of the snowy Peaks by Trigonometrical operations in these low lands, as it would be desirable to have the ultimate sides (serving as a Base) of 20 to 30 miles in length...on the second range of mountains, and in this manner we can of course form a number of long lines from mountain to mountain, using their summits as stations, whence the distances of Snowy peaks will be exactly had, using the circular instrument, & taking the true meridians, &c., in the usual manner, and which I hope to be able to do, when we have possession of the range of mountains south of the Himalaya.

At clear intervals, he took bearings and sketches to the snowy peaks from his traverse stations in the plains, one of them

the Great Peak, I believe Mount Darlinga, and letter O of Col. Crawford. ... This is a very conspicuous cluster, and exposes a great surface of snow to the eye, as the mountains to the south of it are low, and do not obstruct the view. ... The snowy Peaks were only visible three days during February, except indistinctly on some few other days[5].

At the close of the campaign Hodgson was nominated for the survey of the western hills [84], where he had ample opportunity for continuing his observations. The ready consent of Government to a regular survey of the mountains was doubtless stimulated by the views which the Governor General himself had gained during his official travels up-country. He writes of a view at dawn;

8th December [1814]. Moradabad. The sight was truly grand. The snow, illuminated by the beams, looked exquisitely brilliant. ... Yet at this moment I am speculating on the trade which may be carried on beyond it should the present war with the Gorkhas leave us in possession of Kemaoon. ... The holding of Kemaoon would give to us the exclusive purchase of the shawl wool, to be paid for in cutlery, broadcloth, and grain[6].

Lord Moira was here expressing the sentiments which had governed Englishmen in India for the previous two hundred years, and which had been repeatedly impressed by the Court of Directors on their representatives in India. Commerce came first in all things [I, 73–4].

[1] Journal, MRIO. M 347. [2] Mackenzie to SG., 17–7–14; DDn. 136. [3] to SG., Lowtun, 30–12–14, DDn. 136. [4] ib. 2–8–14. [5] MRIO. M 330. [6] Hasting's *Journal* (132).

WAR IN THE HILLS, 1814–5

The Nepāl War was won by Ochterlony's bold leadership and the gallantry of his troops through the Simla Hills and Sirmūr [42–3], with Nicholl's capture of Kumaun as an effective side-show. The leadership of the main columns from Gorakhpur and Dinapore had been spiritless, and their hesitating advance had petered to nothing [41–2].

Gillespie's advance into the Dūn [135 n. 4] had been foiled at Kalanga [pl. 10] where he lost his life[1],, and Martindell, who took command of the column after Kalanga had fallen and the Dūn had been occupied, was held up at Nāhan, capital of Sirmūr. The newspaper report of the disaster at Kalanga refers to "the very defective topography of that district contained in our maps"[2], but even if a copy of Hodgson's survey had reached Gillespie, it would surely not have affected the issue.

Since 1810 Ochterlony had been disturbed by the Gurkha penetration into the hills towards Simla "attacking and taking possession of one fort after another[3]" [81–2]. He had sent an Indian agent "instructed in the use of the compass and surveying" into Sirmūr[4], and embodied his work in

a map and report of the hilly districts between the Jumna and Sutlej. That both are very imperfect, I most sincerely regret. ...

To confess that the accompanying map is entirely constructed from Native information is at once to disclaim all pretension to geographical precision or accuracy but, in addition to the usual difficulty of fixing the position of places from the vague & indeterminate assertions of men who have not the least knowledge of the compass, ... great embarrassment and perplexity have been caused by the mountainous face of the country, which rendered it impossible to ascertain with any hope of correctness the real distance of any one place from another...

Though it is anxiously hoped the map may be of some use to give a general idea of these mountainous regions, it cannot be too often repeated that it must only be received as the best procurable, and not with any reliance on its accuracy[5].

Commissioned in 1814 with the task of clearing the hills, and with no better map than that just described, Ochterlony's force marched from Ludhiana in October, captured Nālāgarh on 4th November, and advanced steadily through the hills, capturing one fortress after another against stout resistance.

On the capture of the fortress of Maloun...the Goorka commander capitulated, on 15th May 1815, agreeing that the Goorka nation should retire to the east of the Kali[6], and resign to the British all the provinces from Kumaon westward[7].

On 30th March 1815 an independent column under Nicholls had advanced from Morādābād and occupied Almora on 9th April. An unfortunate disaster occurred to Hearsey's detachment of irregulars that was operating with this column, the detachment being surprised and routed, and Hearsey himself wounded and captured. A convention was signed for the surrender of Kumaun on 27th April[8].

Both Hearsey and Rutherford had furnished useful sketches of routes into Garhwāl and Kumaun [40], Hearsey writing from Bareilly in August 1814 ;

I will...furnish you with a sketch of all the passes into the mountains, from the river Sutlege to the Gogra with the country on this side, and places leading to, on the opposite side of the mountains. I cannot promise the whole of the positions being exactly fixed[9].

Lawtie and Hutchinson, attached to Ochterlony's column as engineers and surveyors, have left rough sketches and fieldbooks[10], one of which shows the fort of Malaun before capture. Lawtie distinguished himself time after time at the assaults of the hill forts, before his untimely death from fever[11].

Blane, who had been wounded at Kalanga, was detached from Martindell's column in December, and deputed to survey "Jounsar and the possessions of the Sirmoor Raj between the Tonse [83] & the Jumna"[12]. In July 1815 he reported from Sahāranpur the completion of this survey, including "the fords & Ghauts of the two rivers, with their courses for a considerable distance"[13]. His survey was greatly facilitated by the close interest taken by the political officer, William Fraser, whose brother James[14] visited the sources of the Jumna and the Ganges during July [78].

[1] 31–10–14. [2] *CG.* 17–11–14. [3] *Ludhiana Rec.* (197) 5–4–10. [4] B Pol C. 23–6–14 (38–9). [5] Letter dated 29–8–14 ; B Pol C. 20–9–14 (19) ; *Ludhiana Rec.* (396). [6] Still the W. boundary of Nepāl. [7] Prinsep, I (174). [8] *Nepaul Papers* (570). [9] ib. (47, 51), 24–8–14. [10] Rough sketch, MRIO. 10 (10); Fdbks. ib. M. 385, 546. [11] 5–5–15. [12] BSC. 25–1–15 , *Nepaul Papers* (312); Jaunsar-Bāwar now form Chakrāta Tahsil. [13] DDn. 136, to SG., 2–7–15. [14] ib. 3–4–15.

CHAPTER VII

SURVEY OF MYSORE, 1800–5

Preparations, 1799 to January 1800 — First Season, February to October 1800 — Sonda, 1800–1 — Second Period, October 1800 to January 1802 — Third Period, January 1802 to October 1803 — Fourth Period, October 1803 to December 1805.

AFTER the capture of Seringapatam and the death of Tipu Sultān, 4th May 1799, Mackenzie assisted the Mysore Commissioners by compiling maps of the frontiers from the meagre and unsatisfactory materials that were the best available [I, 119]. On his return to Madras, much shaken in health, the Governor General appointed him, early in September, to undertake

a survey on an extensive scale of the territories lately subjected to the Company and to the Rajah of Mysoor ; such a survey is in the first place absolutely necessary to the accurate settlement of our frontier ; it will also tend to augment our knowledge of Indian Geography, and to produce immediate and important benefits in establishing and conducting our government in the conquered provinces, for I propose that the attention of the Surveyor should not be confined to mere military or Geographical information, but that his enquiries should be extended to a statistical account of the whole country, and that he should be supplied with the best means in our power to assist him [2]. ...

In order to assist Captain Mackenzie in his enquiries, I propose that Doctor Heyne, the Company's Botanist on this Establishment, and Mr. Mather, who has lately given proofs of his accuracy in the survey of the Baramahal [I, 114, 354–5, pl. 9], be attached to that officer[1].

The survey was to be carried out under the general control of the Resident in Mysore, Barry Close [49 n.12], who directed that "a minute survey of the boundary of the Territory belonging to the Rajah of Mysore" should take first priority[2].

The survey of southern boundary eastward from the Gazalhati Pass had already been allotted to Thomas Sydenham [I, 194], but as his health had broken down, Mackenzie asked Close that Warren might replace him ;

Lieutenant Warren of 33rd Regiment, who is here now, & well known to Colonel Wellesley, is desirous of being employed in the Mysore Survey. Tho' my own opinion is that the work would be sooner completed by several Surveyors working in concert, ... yet I do not wish to propose this till I am favoured with your sentiments, as probably the additional Expence might not be approved of. But he might be employed on the business which Mr. Sydenham was to have executed[3].

Close supported this proposal,

as the business of surveying is laborious and particularly severe on the constitution, and as dispatch is desirable in perfecting so great an undertaking[4].

Hampered by ill-health, Mackenzie spent several months at Madras making preparations and collecting instruments, equipment, and staff, and formulating a detailed programme. After consultation with Close he submitted on 5th January 1800 an elaborate *Plan of the Mysore Survey*[5].

The *Survey* of *Mysore* should embrace two great leading objects, *Mathematical* and *Physical*. ...

The Mathematical Part including a Geographical and Geometrical survey will comprehend ;

1. A *Survey* of the *Frontier* and *Exterior Boundaries* of *Mysore*...according to the Treaty of Partition of June 1799. ... The ascertaining with some precision the boundary and line of demarkation between the Rajah of Mysore, the Nizam, and the Mahrattahs, is necessary to be attended to early, in order to avert, or clear up, any difficulties...from the intermixture of

[1] Minute by Lord Mornington ; MMC. 4–9–1799 ; cf. Secretary's letter, DDn. 63 (3). [2] DDn. 68 (169), 21–11–1799. [3] DDn. 41, 14–11–1799. [4] DDn. 68 (169), 21–11–1799. [5] MMC. 11–2–00 ; see also BM Addl MS. 13659 (227).

inferior Divisions, from parts of Talooks or Purgunnahs being sometimes insulated...from their ancient Cusbas [103][1]. ...

The new Boundary also, with our Provinces of *Coimbatoor*, with that of *Malabar*, our new possessions in Kanara, the Koorg Rajah, and our new *Western Boundary*[2], ... all require investigation and to be previously fixed. ...

2. A Series of *Primary Stations* to be obtained throughout Mysore in all its extent, for which the Country, from its numerous Peaks and Hills, many of them remarkable for the buildings upon them, is peculiarly favorable, forming a series of Triangles connected by Bases to be carefully measured, ... and joining the Surveys already executed in the Malabar Province on the west [I, 131–2] with that of the Baramahl on the East [I, 114 II, pl. 11], will form the ground of a work mutually illustrating, and correcting, the labours of the several surveyors employed afterwards on the several portions of the Country in detail (see 3), and from the combinations of the whole with those on the *Malabar* and *Coromandel* Coasts, will be materially useful in extending the result not only to both Seas, but, by following the same plan to the Frontier North and South, will lay a foundation for obtaining a more correct system of the General Geography of the Peninsula. ...

3. On this...foundation the Country in detail is to be laid down. The Position of every Town, Fort, village, ascertained by correct bearings of the Primary or Secondary stations, a register of which should be preserved for reference and verification afterwards; beginning with the parts next our frontier, and proceeding in succession to embrace every individual plan, carefully remarking all the rivers and their courses, the roads, the Lakes, Tanks, Defiles, Mountains, and every remarkable object, feature, and property of the Country.

In this manner, by laying down the smaller Districts or Purgunnahs and their respective boundaries in detail, the limits of the greater Divisions will naturally follow. ... Mysore Proper ; ... *Sirah*, ... *Coimbatore*, now wholly belonging to the Company ; ... *Chitteldroog*, *Bednore*[3], or what is above the ghauts ; *Canara*, or rather that part of the ancient Country so called, and laying on the Sea Coast, with the Lower Part of Bednore and Soonda [I, 131 II, 96–7, pl. 11]. Soonda, Harponally[4], Anagoondy, ... ceded to the Maharattahs or Nizam, or still occupied by our troops, may be eventually included. ...

The Provinces of *Coimbatore* and *Canara*[5], being wholly ceded to the Company, may perhaps not be understood to be included in the survey of the Rajah's Territories, but...they ought undoubtedly to form part of the general system.

4. The situation, Extent, Figure, and contents of the Country in all its Divisions being thus obtained, ... the position of the principal points ought at the same time to be corrected by *Astronomical* observations connected by a series of triangles. ... This branch might be executed by persons expressly employed for this purpose, acting in connection with the general survey, and duly communicating its progress ; the corresponding observations being also regularly transmitted to the observatory at Madras. ...

5. But another important Branch, a *Land* or *Agricultural* survey would be equally desirable. ... It would include the Divisions of the lands into Hills and Mountains, plains and valleys, cultivated and waste, the species and quantity of each kind of cultivation ; the Revenues, allotments of Land, also the water works, canals, reservoirs, and a number of objects connected with these. ... But whether the time and labour required for its execution could be spared from the immediate calls of the other deserves consideration.

II. *Physical*. This Branch includes all remarks, facts, and observations, that can be conducive to the improvement of *Natural History* [113–5]. ...

Particular Branches. 1. Botany, Mineralogy, Medicine. ...

2. The Diseases, medicines, remedies, etc. ...
3. The air, *climate*, seasons, periodical rains [105].
4. *Soil*, its produce, modes of Cultivation, water works, tenures of land. ...
5. The various descriptions and classes of *Natives*, their customs, languages, manners, etc. ...
6. *Animals*, wild and tame. ...
7. *Revenues* and *Population*. ...

Mackenzie asked for the employment of at least four surveyors on the detail of the whole country, but as the expence of such an Establishment might at once be deemed too great, ... it might be sufficient to employ, for the first season, the number of Assistants already appointed for this purpose ; I have however little doubt that the employing several competent surveyors at once would be ultimately found *more satisfactory and economical*. ...

[1] Headquarter town. [2] of the Carnatic. [3] Mysore, 57 D/11 : Sira, 57 C/14 : Chitaldroog, 57 B/8 ; Bednur or Nagar, 48 O/1 see pl. 11. [4] Harpanahally, 48 N/13. [5] Had been annexed by Haidar Ali [I, pl. 9].

In addition to the duties involved in that of the General Superintendency of the whole, the particular survey of the Frontier, perhaps of some Districts, and many details of arrangement, ... it is proposed that the Superintendent dedicate as much of his time as possible to institute a series of Enquiries into the *Statistical History* of the Country [2, 107, 111]. ...

It is to obviate any doubt of the practicability of this plan...that I have delineated, at a length requiring some apology, the mode that I would propose for carrying on these surveys, by a succession of persons working in concert, ... as being less liable to interruption from the casualties so often detrimental to Indian Surveys.

In laying this before the Resident, Mackenzie recommended that the *agricultural* survey "should be executed separately after the first part, or else we run a hazard by undertaking too much at once, of retarding and confusing the whole", and indeed this part was never carried out [184].

He continues ;

I propose to send Mr. Mather up to measure a Base in some convenient place this side of Bangalore, which will serve to connect the angles and stations he will be directed to establish in the Ballaghaut[1] with those already taken in Barramahl, and, after extending those so as to embrace the chain of hilly country dividing Seringapatam from Bangalore, and fixing a Series of Primary points in that tract, from the Cavery North to the parallel of Nundydroog[2], ... a country well adapted for these operations by its remarkable points and Peaks, he will next proceed to survey that Portion of the country in detail, ... so that we may expect in one Season, if not interrupted by unforeseen accidents, to have this completed by him alone ; after which the tract extending thence West to the Ghaats may be undertaken. ...

I propose...myself...examining the Northern parts...circuitously round to the Bednore side, as soon as my state of health and the approach of the dry season will permit. I am more desirous of going myself into this part of it, as it connects with the Surveys I have seen carrying on in the Nizam's Country, and the mutual boundaries of both will require early illustration in these parts ; my anxiety would have induced me to enter on it immediately, did not the earnest advice of the Medical gentlemen and common prudence weigh with me to postpone the attempt for some time longer, for tho' my health is considerably recovered, and my complaint removed, a relapse would be not only dangerous but entirely overthrow the Plan of this Survey, so far as my slender tho' earnest exertions might be hereafter required[3].

A month later ;

I have waited some days to acquaint you of my sending off Mr. Mather, the Board having approved of the Establishment proposed for him and Mr. Heyne and, the several Indents for Instruments, Camp Equipage, and Lascars, being now countersigned, I hope in a very few days to acquaint you of his proceeding towards Mysore. ...

I am fully occupied here in a manner that I hope will conduce to the accuracy of the Survey and will enable me to enter upon it better prepared, so that the Northern Frontier, and perhaps the Circuit of the whole, may be taken by myself in less time, by being previously informed of the districts thro' which it will run, and this will be more necessary as it may be liable to alterations before it forms a *permanent Boundary*. ...

Neither the state of my health nor the season could admit of my proceeding earlier, and all the Arrangements of people, Equipage, and Instruments, which always take too much time here, will be in the meantime effected, besides much done in digesting a body of Preliminary Information on so extensive a subject[4].

In due course all preparations were completed ; Mackenzie, with Mather and Warren as surveyors ; Dr. Heyne, in charge of botany, mineralogy, and natural history ; several boys from the Observatory Surveying School [343] ; lascars, artificers, and all necessary equipment and instruments ; the first completely organized survey expedition to take the field in India.

Mather and Warren, forming the first contingent, left Madras early in February 1800.

FIRST SEASON, January to October 1800

"On 25th January 1800", writes Mackenzie,

the General Plan of the Objects and method proposed for executing this survey was sent in

[1]The Mysore Plateau [I, 244]. [2]57 G/11. [3]DDn. 41, 9–11–1799. [4]ib., 5–12–1799.

to Government and approved of, as were the measures previously proposed for employing two Assistants, Messrs. Warren and Mather, who were instructed in January 1800 to commence the Survey in Districts nearly adjacent to each other, to the Barramahl already surveyed, and to the Eastern Frontier[1]. ...

It was the 10th of March before I could leave the Presidency in a state to undertake the survey, originally owing to bad health, but latterly to the necessity of making preparatory arrangements. Immediately before I left Madras, receiving intimation[2] recommending the survey of the boundaries of the Soonda, & of the Rajah of Mysore's territories with the Mharattas, as a primary object, I determined to proceed directly through Mysore towards the North West point, there to begin with the exterior frontier.

On the way I visited Seringapatam from Bangalore during April to arrange various details, and eventually left Bangalore on May 8th[3], reaching Chittledroog on May 21st[4].

To help in his general survey, Mackenzie secured the help of James Colebrooke, commanding the Corps of Guides at Seringapatam, and he writes to Wellesley just before leaving Madras ;

I some time ago received by the Post a Copy of Captain Colebrooke's Plan of the marches of the Army [122]. ... I should long since have returned you my acknowledgements for this additional proof of your remembrance, had I not thought you would be better pleased at the same time to know of my being on the point of commencing my Journey. Tomorrow my Tents will be off, and I follow next day. ...

I suppose it will be necessary to have a respectable Guard in this situation, and I presume the Resident will take every measure for procuring me the assistance the country and its managers can best afford ; but I beg to suggest to you the expediency of giving some intimation to the Commandants of the military Posts to give me every assistance. ...

I proposed to Captain Colebrooke to send some of his guides with me ; ... I hope your permission will be granted for his detaching any two he chuses, to meet me at Bangalore or its neighbourhood[5].

To Colebrooke he wrote ;

What I propose is that the confidential person you send, with as many guides with him as you can conveniently spare (suppose two), should keep a field book, for your use, of the roads they travel along with me, or near me. ... You will by this means have the results of their Journey added to your stock of information, and I shall derive immediate assistance from their talents[6].

This general survey of the roads was extended by Mather and Warren, and copies supplied to the Quartermaster General[7] [103, 104]. In his first report to the Governor, Mackenzie writes ;

The Survey of the Roads, Passes, & Objects interesting in a Military & Geographical light, I began from Conjeveram[8]. I do not now accompany these with Tables of the distances ; ... they will...follow...with a General map of the Roads. It were to be wished that the Surveys of the Roads effected for some years back with our armies were arranged on this, or some other, uniform method, which would make them more useful for reference on the march, & for encampments. ...

Though the partial Surveys of Fortresses, or Posts, was not part of my original Plan, as I apprehended it might interfere too much with the proper objects of this undertaking, I ventured to depart from this rule in a few instances[9].

Wellesley was at this time commanding a large force on the north-west borders hunting down a Marātha freebooter named Dhoondia and, writes Close ;

Anwutty[10] and the Southern parts of Soonda have been lately disturbed by Robbers who possibly belong to Dhoondiah, and this Free-booter, by the latest Accounts, lay with a considerable number of Followers on the Northern limits of the Savenore Province. At present we have a large Detachment at Hurryhur, and we shall soon have a Battalion at Honelly[11].

I would recommend therefore that you carry forward your Survey to Hurryhur, and proceed as circumstances may permit. ... The propriety or otherwise of your crossing the Toombuddra[12]...must be determined by the State of the Frontier at the moment, and the Escort which the Hon'ble Colonel Wellesley may be enabled to furnish you with.

[1] DDn. 42, View (8). [2] From GG in C. to Mad. ; MMC. 4–3–00 & DDn. 68 (34), 4–2–00. [3] MRO. map 222, Boundary of *pargana* Bangalore, survd. by James Ross, April & May, 1800. [4] DDn. 41, 11–10–00 ; Report to Governor, Madras. [5] DDn. 41, 7–3–00. [6] DDn. 66, 12–3–00. [7] DDn. 41, 17–6–00. [8] 51 P/9. [9] Report (14–5) ; DDn. 41, 11–10–00. [10] Anavatti, 48 N/2. [11] Savanur, 48 N/5 ; Harihar, 48 N/14 ; Honnāli, 48 N/12 ; see pl. 11. [12] Tungabhadra R., 48 N, 57 A, E.

Was the Maratta Territory on the North Western Frontier under a regular Government, it would be very desirable that the line of Boundary should be laid down in the presence of Persons appointed for the purpose by the two Governments respectively, but at the present the Savenore Province is extremely disturbed. Appah Sahib, the Maratta Chief, to whom it seems to belong, cannot give it protection or reduce it to any fixed Form of Government. ... Under such circumstances I conceive it may be most advisable to lay down the Boundary as it may be ascertained from the Reports of the Revenue Servants, and an examination of the Territory accounts[1].

Mackenzie replied from Harihar[2] ;

I was advised by the Hon'ble Colonel Wellesley of some parties of Banditti having entered the Soonda Country ; who cautioned me against proceeding into that district, as a sufficient escort could not in these circumstances be afforded. I therefore awaited his arrival to accompany him to this place, but my illness in the meantime intervened. In conversation I then had with him, he was decidedly of opinion that the Survey of Soonda could not at this time, with any regard to prudence, be attempted, & the nature of that Country at this advanced season rendered it still further improper to hazard the health of the whole party[3].

During July he surveyed the boundary along the Tungabhadra between Honnāli and Harihar, reporting to Wellesley ;

The Rains setting in very severely, I found it necessary to lay aside that design [the survey of Sonda] for this season, as it would be dangerous to health to go among the Jungles & hills in this wet weather. The river was much swelled & rapid for 3 days, & [I] took the first favorable interval to recross it. I am now tracing another route back to Hurryhurr, where I propose carrying on the Survey of the frontier till that of the Mharattas & Nizam's meet. ... By the accounts of all the Amuldars, the country was perfectly quiet from Anawooty Southward. ...

I propose to send in to Government a Report or View of the Progress already made when I have done with the Mharatta Boundary and, as I have much writing to copy off in triplicate,...I have most earnestly to request the favor of your intercession with Colonel Montresor[4] to permit me to retain the man I have got from the 77th Regt.[5], at least till I effect this. It is of some import to the speedier Progress to have these reports made up soon, as my Enquiries into the State and History of the Country increase every day, along with the other objects of the Survey[6].

He writes to Close from Harihar;

I returned here yesterday after surveying the Boundary of the Rajah's Districts with those of the Mharattas...as far up as Honelly. The Toombodra, which in fact forms the Boundary so far, having risen very high & overflown the numerous ravines running from it, rendered the Survey very tedious, as I laid down every village &c. on either bank, & paid a minute attention to the rivers[7].

Whilst held up at Harihar by the rains, Mackenzie measured a base-line ;

This situation being also favourable to establish some foundation for correcting this survey, ...I availed myself of the nature of the ground, the favourable weather, and the well defined points (many surmounted by buildings), to have a convenient base measured with some accuracy, extending 4,400 yards, and permanently marked by stones firmly inserted at each extremity [105, 204].

In this work, which is so necessary to all Surveys, ... I derived considerable assistance from the Industry and Assiduity of Ensign Arthur, who joined me at Bangalore on 27th April, & has ever since assisted, along with me or detached, on the more active duties of the Geographical Survey, and in taking observations to ascertain the correct positions of the different places. ...

I had early commenced an Enquiry into the Extents, Limits, Subdivisions, Population, and Productions, of the several Purgunnas we passed through[8].

He halted at Harihar till October, when he sent Government a full account of the work up to date, including that of Mather and Warren to the south-east ;

I had it in view by this Survey to obtain a detailed knowledge of these tracts, usefull to an exact adjustment of Frontier with Mysore on that side ; for though these districts had been repeatedly traversed by our Armies & were always the first scenes of our operations in Mysore, the internal Divisions & Boundaries had not been noticed. ...

[1] DDn. 68 (201), 27–5–00. [2] Well-known to air-surveyors of 1944. [3] DDn. 41, 1–7–00. [4] Sir Thos. Gage Montresor (1774–1853); Ens. 18th Foot, 1789; comdg. Poona Subsy. Force, 1809–13; Gen. 1841. [5] Private Haslam of E. Middlesex Regt. [6] DDn. 41, 26–7–00. [7] ib., 1–8–00. [8] ib., 11–10–00.

Mr. Mather's health being unfortunately injured by his former labours of this kind, though he had proceeded up in January, it was far advanced in the season before he could begin; he, however, by his Industry & experience was enabled by the 7th of August to send me Plans of the Districts of Ossoor, Bangalore, Ankusgery, & Solagery, being a Survey comprehending every village & the Boundaries within a space of nearly 490 square miles[1].

Lt. Warren also entering on the tract committed to him early in February commenced his Survey by measuring a base of considerable length on a regular systematical Plan, and by the last Report from him had, after completing it and establishing his Stations, very nearly completed a Survey of the Purgunna of Ooscotta[2].

In acknowledging this report and sanctioning his various requests, Government desired Mackenzie to

issue such orders relative to the details of the Survey, as you shall think calculated to extend the sphere of information, and to combine the whole subject in a comprehensive and distinct view[3].

SONDA[4], 1800–1

When in July 1800 Mackenzie had found himself prevented by the campaign against "Dhoondiah Waugh" from surveying the frontier between Sonda and the Marātha district of Savanur[5], he obtained permission for the survey to be taken up from the other side by Johnson of the Bombay Engineers, then stationed at Goa [156], and wrote to him from Harihar [95];

The Survey of the Frontiers with the Mharattas was particularly recommended by the Supreme Government to be first attended to; in compliance with this I came here; ... but as...your situation particularly qualifies you for more conveniently executing the detailed Survey of the Province of Soonda, Upper and Lower, ... I think it would be a proper object for you to attempt, as well as the Portuguese Territory, as soon as your health and the weather would permit. ...

I always supposed the whole of Lower Canara was to be executed by the Bombay Surveyors, and understood Captain Moncrieffe had been employed on the Northern Part [I, 132]. Let me know how far his limits extended.

I know Major Munro [158] wishes to have a detailed survey of Soonda executed in the same manner the Baramahl was [I, 144], with all its interior Divisions, Boundaries, Villages, Tanks, & the quantity of land, waste and cultivated; you should therefore consult him, and by the time I have Colonel Close's reply you may be able to make your application. ...

You will observe that the Survey of the Frontier is not merely a military one of the roads, but takes in the actual Boundaries, Land Marks, and Divisions of the Countries on both sides, and perhaps it may be therefore desirable to have it continued on the same Plan by one person; but as I have sufficient work afterwards to occupy my own, and my assistant's, attention in Mysore, my private opinion is that a Surveyor would be usefully employed to execute the whole of Canara, Soonda, and the Goa territory (while we have the latter in our power)[6].

By November Johnson was placed under Mackenzie's orders[7], and given the following detailed instructions;

You will as soon as possible proceed to Survey the District of Soonda above the Ghaats. As the Frontier with the Mharattas...is considered one of the first objects to be attended to, I hope you will be able to commence with it in the first place, from where it connects with the Portuguese territory of Goa, or the Lower part of Soonda, till it touches the Bednore District[8] near Anawooty. The parts of Soonda below the Ghaats may become an object of the Survey afterwards. ...

After laying down the Exterior Boundarys, you can next proceed to that of the Interior, in the course of which you will have opportunities of inserting the several Cusbas, Forts, Villages, the Roads and Rivers with their courses, the Ridges of Hills, and every object interesting on a Geographical or Military light. To forward which you should previously get a List of the Villages in each District from their respective Amuldars. ...

[1] Hosur, 57 H/14; Ankisgiri Drug, Sulagiri, 57 L/2; Map, MRIO. 134 (1), one-inch scale. [2] Hoscote, 57 G/16; 1-inch map, MRIO. 147 (16). Mackenzie's Report (19–21), DDn. 41, 11–10–00; BPC. 26–7–04. [3] DDn. 68 (39), 9–2–01. [4] see pl. 11, *Soonda*, now N. Kanara; *Imp Gaz.* XXIII (82). [5] pl. 11, Sanoor. [6] DDn. 66, 7–7–00. [7] DDn. 41, 16–11–00. [8] now Shimoga Dist. 48 N/SW.

It is not my intention to enter into the detail of the manner in which the Survey should be executed, such as measuring a fundamental Base, taking observations for the Latitude and the Azimuth, selecting Primary Stations, etc., as your own experience in this line will point out the measures best adapted for executing it. ...

The Scale used for our Provincial Maps is that of one mile to an Inch, which adopted by you will render the connexion more convenient. It will be usefull also to fix and notice such points and places within the Mharatta bordering Districts as can be conveniently done, and without retarding the Primary object, the Survey of the Frontiers[1].

Unfortunately, after only about a month's work, Johnson was called away for engineer duties, and the survey of Sonda was left for a more favourable opportunity [158].

SECOND PERIOD, October 1800 to January 1802

Starting out from Harihar on 12th October 1800, Mackenzie continued triangulation and survey eastwards towards the mountainous tract of Sandur[2], following the Outward Boundary of the Mysore Dominions with that of the Nizam, taking therewith an Actual Survey of the Districts contiguous to that line. To favor dispatch, a communication was opened with the Managers of the Nizam's Southern Districts, which soon after became unnecessary by their Cession [I, 119 n.3, 152]. ...

The Northern Survey was of itself sufficiently equal to our utmost efforts at this particular period, when...the Country under Survey had been but recently reduced, & had nearly then been the scene of new commotions, but for the Active Movements of the Army ; beyond the neighbouring River [Tungabhadra] its nature wild & Mountainous & little known ; & the season of the year adverse to our operations. ...

As our Party was yet efficient, I had sanguine hopes by the conclusion of the Rainy Season to have surveyed round the Northern Extremity of Mysore, whence its Extension to the Southward was esteemed less liable to obstructions. ... This opinion is sanctioned by the completion of 56 Purgunnahs surveyed, in addition to the most material part of the Boundary. ...

The Party on the Northern Survey consisted only of one Assistant (Ensign Arthur of Engineers), one young man from the Surveying School [James Ross], and an Establishment which...was but barely equal...to the incessant demands...in a wild Country at 400 miles generally from the Presidency, & with few resources but what we had with us. ...

The irregularity of the line of Boundary separating Harponelly [pl. 11] from...the most northerly of the Rajah's Districts...obliged me to spread the Party repeatedly to effect the Survey sooner, reserving to myself, with most of the Outward Frontier, the Investigations of the Country[3].

The Boundary, turning North, ... enters among a wild country composed of several ridges of Mountains. I was thus forced to grope my way in this wilderness composed of the wildest combination of naked rocks & rugged hills (separated by unprofitable Jungles), whose aspects were constantly varying, or their view intercepted by new points & peaks, presented so frequently & so differently in their appearance, that repeated journeys were necessary to select & define Points that, after much labour on tryal, were sometimes necessarily changed for more convenient stations[4]. ...

All these parts are separated and divided in such an irregular manner by this uncommon ridge (in the bosom of which is Sundoor...) as to render it much more troublesome and tedious than I could have foreseen ; but this & ill-defined state of the Boundaries rendered it...more necessary, while we were in the vicinity, to bestow some attention to it for once[5]. ...

By the Beginning of December every object of the Survey was completed from Honelly to the furthest Extremity of Mysore North, excepting Goodicotta, & after carrying on the Series of Angles to...the Fort of Herrial[6] beyond the Boundary...Mr. Arthur parted, to carry on the Survey of the remaining part of the Boundary between Goodicotta & Harponelly[7].

The whole party was now overwhelmed by sickness ;

On our separation at Herial [December 13th], a Cursory Survey was carried by me thro' the valley bordering on the Soondoor mountains on the NE. to the Toombodra at Camlapore[8], ... when...the increase of the Sick...frustrated every attempt for a time. ... I was not myself

[1] DDn. 66, 16–11–00. [2] 57 A/12. [3] Report to Govt. DDn. 42, 12–7–03 (3–6). [4] DDn. 42, Memoir of Survey (15). [5] DDn. 41, 24–12–00. [6] Hirehalli, 57 B/10. [7] DDn. 42, Memoir (22). [8] Kamalāpuram, 57 A/7.

exempted from the general malady, tho' seldom in a degree that prevented the necessary attention to my duties & the state of the Sick.

Removal from an unwholesome air was at this time judged expedient ; but, reflecting that the Sickness general throughout the Upper Country from Soonda to Seringapatam had already affected the Survey in other Quarters, & the danger ensuing to the Work if relinquished in this Stage, I was deterred from proceeding to the Coast, tho' earnestly recommended by different Medical Gentlemen ; the time requisite for such an Extensive Journey, & for collecting a New Party (the unavoidable consequence of the natives visiting their families under this discouragement) would have temporarily suspended, & in all probability prevented, completion altogether ; while by remaining to encourage them & by removing to more healthy situations there was a probability on the commencement of the Hot Season of resuming the operations with more effect.

In this State the total want of Medical aid added much to our distress [360], & I was repeatedly obliged to apply to Chitteldroog & to the Camp in the Ceded Districts for Medicine ; nor were we relieved from this embarrassment until, by the humane sollicitude of General Campbell[1], casually apprized of our situation, a Surgeon, Medicine, & Conveyance, were sent from Gooty[2] for the relief of the Sick, which enabled us to carry them to Rydroog[3] in the beginning of February[4].

Mackenzie writes to Lambton in January ;

I was labouring hard when we were entirely deranged, first by the illness of Mr. Arthur, and then of 17 of my party in one day ; of late however the worst is over, only that his weakness will deprive me of Mr. Arthur's aid for some weeks[5].

and to General Campbell, commanding troops in Ceded Districts ;

I hope soon to terminate this troublesome job, tho' I labor under great debility owing to 10 months incessant labour after the shock my constitution had last year, and I now have this general weakness in consequence.

On reaching Rydroog I have next to Survey the irregular Boundary of the E. side of Chitteldroog, ... Sera, and then from near Ruttingherry turn E. towards Hindooporam[6], and the S. Boundary of Nundidroog, and perhaps closing at Amboor, where I began in March last year. I expected at one time to have completed this (about 300 miles of Boundary), besides the Investigations of the Country, before the end of March, tho' I am now doubtful, alone and unsupported, if I can do it in that time ; the construction of the Maps and Details of the Country are next to follow, so that I have a very audacious task to perform[7].

Arthur went down to the Coast in February, and after working eastwards to "a labarinth of rocky Mountains" near "Nidigull and Mudgery" [pl. 11], Mackenzie brought his triangles back to Chitaldroog by the middle of May ;

After a stay of 33 days at Chitteldroog, which was barely sufficient for the repairs of a decayed Field Equipage, replacing the Cattle, & various necessary articles wanting after a journey of 15 months ; some respite of rest to our harrassed Party, & the relief of the Guard, exclusive of the time required for the Investigations of that Country, its Divisions, Boundaries, etc., ... I proceeded (June 28th)...to the Westward, having previously removed to Serah, as the next central point of operations, the Stores and Necessaries not immediately in use[8].

The greatest Part of the Province...of Chitteldroog, comprising...3,850 Square Miles, being surveyed by means of the Triangles now established, the further extension of these to the W. and SW. became necessary for closing the whole ; to effect this a Journey to the Westward... became necessary. The approach of the Rainy Season hastened our departure, as the severer falls of rain might effectually preclude any attempt for several months if not taken at this time, while the Eastern side, being supposed less obnoxious to that inconvenience, could be taken with more safety thro' all seasons generally.

From the 28th June to 30th July a Series of Triangles were extended, connecting the former stations of Chitteldroog, ... running to the Southern Extremity of the Chitteldroog District. ... In consequence of the Foggy, Cloudy, Weather incidental to this Season, that (enveloping the higher summits of the Mountains in Vapors seldom dispelled till late in the day, & then only partially) obstructed distant Views of the most eligible Points, ... I did not... attempt to take more than were requisite for a detailed Survey of the Western Part of the Country & Boundary, in a manner admitting of correction afterwards...in more serene weather.

[1] Dugald Campbell (1742–1809), Mad. Cav. ; Comdg. in the Ceded Dists. 1800–3. [2] 57 E/12. [3] 57 B/14. [4] DDn. 42, 12–7–03 (10–1). [5] DDn. 66, 12–1–01. [6] 57 G/9 ; 57 G/11 ; 57 L/9. [7] 26–1–01, DDn. 66. [8] DDn. 42, 12–7–03 (24).

The rain becoming still heavier, & sickness again appearing among our party, I proceeded Eastwards...to Heroor [July 29th], situated in a more open Country & Salubrious Air, between Serah & Chitteldroog, where we arrived on 30th June. ...

While the Quarters of the Party remained Stationary at Heroor for 29 days to promote the recovery of the Sick, & to bring up the Drawings & other combinations of the Survey, which by the late rapid execution of the Field Work devolving upon one person singly had considerably accumulated on my hands, repeated excursions were made in different directions ...to Survey the remaining parts of the Provincial limits of Chitteldroog. Connecting Stations were established on...the first of the Points fixed in Major Lambton's Survey that we fell in with [117–8][1].

Being joined at Hiriyūr by Heyne and Arthur, Mackenzie proceeded Eastward...to carry the Triangles...to the banks of the Pennar, whither Mr. Mather was to carry his Survey to a common point of Junction, but this design was again interrupted by the serious illness of Mr. Arthur. After extending the Stations...to Mudgerry...I went into Serah on the 8th September to arrange measures for effectually closing the remaining part.

The approach of the N.E. Monsoon...spreading generally to this part of the Country left me no time to lose, & as the care of the Sick had already retarded more active exertions, the Assistants & some of the followers in a state of Convalescence under the care of the Surgeon were left at Serah, while I proceeded with a party barely sufficient for the necessary operations, and a reduced Field Equipage. ...

Between the 29th of September & the 7th October the Boundary...was surveyed round Mudgesy ; thence E. & S.E. to its termination...on the Pennar, where Mr. Mather, after surveying a great part of Greater Ballapore, met me. ... Part of the line carried by me at this time thro' a tract extremely Mountainous & Jungly, tho' only about 25 miles in a direct distance, was 71 in the measurement of the Boundary ; on the whole of this Journey I travelled 158 miles before I reached Pennaconda on the 11th October, to proceed to survey the District of Paughur [pl. 11]. ...

The Survey of the Paughur District & part of Nidicull was then begun ; ...—frequent rains —We were fortunate however to close that laborious part round the Mountains to the Pennar again...by the 9th of November. ...

After a detention of 3 days at Paughur by illness, I was barely able...to close on some small insulated Tracts...belonging to these districts, ... after surveying on this Journey 241 miles & 40 yards from 30th September to 16th November[2]. ... After this harrassing Journey of 48 days in the rainy Season, in constant movement with few halting days, ... we returned into Serah (November 16th 1801) without any Sick (my own case excepted). ...

Tho' we had escaped from any ill consequence at this time, the Party...naturally looked forward to some relief from a severe duty, that...gave them some claim to that respite, which might have been equally beneficial in the reduced State of my own health. ... But in this State of the Survey...it was due in justice to our Employers, and I may add to our credit, that it should be closed with all the accuracy then possible to give, to join the Extreme Stations of the Northern & Southern Surveys, to verify both Bases by a re-measurement at Ballapore[3], & to fix the Principal Points of connection on the Western & Eastern Lines of Primary Stations, which the heavy weather of July had prevented; ... for which two different and distant journeys were necessary, tho' at the hazard of further personal exertion & risk of health.

Mr. Arthur's health being still precarious, and not equal to the more exposed duties of the Field, he was directed, ... to close the connection with the Base at Ballapore, while I proceeded by Chitteldroog...& thence extended the Stations to adjust that side of the Series, ... & I proceeded thence to Seringapatam (December 3rd)[4]. ...

From the 3rd to the 15th December, by travelling fast (but under repeated returns of the Ague), I was enabled to take the Stations that were wanting to complete the Series. ... The Serenity of the weather & clear unclouded Sky at this Season enabled me to obtain from the Summit of Cottacull a view of Nidicull so much wanted, and which alone rendered the Journey necessary. ... I proceeded to Seringapatam & then to Ballapore, where on on the 5th January Messrs. Arthur & Mather had completed the re-measurement of the Base before my arrival[5].

The following are Mackenzie's instructions to Arthur for the remeasurement of Mather's base at Ballapore [205–6] ;

[1] DDn. 42 ; Memoir (29–34), 25–5–03. [2] ib. (36–41). [3] Dod-Ballāpur, 57 G/11. [4] DDn. 42, 12–7–03 (27–8). [5] ib. Memoir (46).

Wishing to close the Work...with the greatest accuracy it can admit of, so as to enable the continuation of it to be readily taken up from the Extreme points of this Survey, I propose taking a circuitous journey of a few days to connect the Western part with the Northern and Eastern points, which are separated by the Western ridge of hills, ... after which I propose going to Seringapatam on business.

As I am desirous in the meantime to connect the furthest points of our Survey here with that carried on from the South by the other Survey, and that the re-measurement of Mr. Mather's base...will be useful, not only for a verification of the Triangles carried on from Hurryhur, but for connecting the whole of this work, and also serving as a base to extend the Surveys then to the westward ; and tho' your lately recovered state of health does not appear to warrant your immediately going into the more laborious duty of the detailed Survey, yet, as you seem to think you can without risque take such Stations as are necessary for the connexion with the base, I have to request, in your Journey South towards Nundydroog, that you will take such as conveniently lie in the way, ... until you can connect this point with the base near Ballapore[1].

There was indeed a further reason why Mackenzie was particularly anxious for his work to reach the highest standard possible, and that was his desire for it to prove well when connected to Lambton's triangulation, which had started early in 1801 [3, 118]. There had been some mention of a discrepancy between their measurements, and Mackenzie writes to Arthur ;

I send in purposely for your perusal a letter from Captain Colebrooke, where you will see a very clear and gentlemanly statement of what passed at Bangalore regarding an error of 24 miles imputed to my measurements ; I had applied to him for a comparison of our measurements, and you will observe how they agree. ...

The Angles I take now...may possibly correct these, or reduce this distance, which I imagine has grown up insensibly. ...

A base at the termination will be necessary to correct it as much as possible, and I have thoughts for this purpose of measuring that taken by Mather not far from Mudgery, because it answers the double purpose of connecting the whole of the Surveys of the East side together. ... Then the Correction of Lambton's may be applied in general, as intended in the Institution of that work [234].

Lambton proposes still to measure two Bases from the Coast to his present ; he is also directed to remeasure his first base for greater accuracy and verification[2] [256] . ...

I am truly glad that matters are in such train for measuring the base ; at present I do not consider it of that importance as to require much time, as the angles taken from it agree so nearly with those of Lambton's base ; but it will be useful to measure it once or twice to satisfy all parties ; and if any time hence it should be judged necessary, another might be taken more deliberately in the hot dry season, clear of the inconvenience of water, etc[3].

Arthur's account of the measurement of this base is given later [205–6], as also is Mackenzie's comparison of the closing between the different sections of the triangulation [207–8].

Meanwhile Warren and Mather had been making good progress to the south, working on technical instructions issued from Harihar in October 1800 [97, 211].

Mr. Warren had completed Ooscotta and Jungumcotta, and was directed to survey Colar [pl. 11]; and Mr. Mather had, after completing the more Southerly Districts of Ruttingury and Denkanicotta, been obliged to suspend that of Alambaddy next extending along the Cavery, from the unhealthiness of the season and country. I had therefore directed him to survey Ballapore, Donelly and the North East Districts south of Mr. Warren's, with a view of sooner concluding by their united labors the whole line of exterior boundary with the Districts adjoining, by the time I estimated to connect our operations on the Pennar River[4].

In October 1801 Mackenzie wrote to Warren ;

Having lately united my survey of the Boundary with the Ceded Districts[5] with Mr. Mather's survey in Burra Ballapore District, I have directed him...to extend that of the Outward Boundary round...till it meets the Outward Boundary of Colar Purgunnah. ... I recommended him to acquaint you, that you may be able to effect a meeting with him for uniting your two Surveys of the Outward Boundary at some landmark, as done lately on the Pennar[6].

[1] DDn. 66, 3–12–01. [2] ib., 12–10–01. [3] ib., 18–12–01. [4] Mather's Memoir, 1800–1, MRIO. M 116; DDn. 42, 12–7–03 (22). [5] Map entitled "Survey of the Northern Division of Mysore, ... 27th. June 1800 to 15th Dec. 1801", MRIO. 132 (15). [6] Pennar R., 57 G to 66 B.

As soon as your attention can be spared from the completion of the Ooscotta Map, ... you should turn your first care to the Survey of the Outward Boundary of the Colar Purgunnah, ... from the Southern Extremity till it meets Mr. Mather's on the North, leaving that of the Interior Country till this is first finished. By this means the Line of Outward Boundary will be completed from the Toombodra to near the Cauvery. ... Your Primary Stations of connexion may be extended at the same time from the furthest taken by you on that side to the Boundary, and to connect with Mr. Mather's [207][1].

To both Warren and Mather he writes ;

Being desirous that the Survey of the Outward Boundary with the Ceded Districts should be laid down on one Uniform Plan, I have to request, in protracting your part of it, that you will use the Scale of two English Miles to an Inch (that is, one half of that used for the Provincial Maps). The Extent of the whole Line of Frontier to be laid down on one Chart rendering this less bulky and equally convenient for that purpose[2].

On conclusion of his final trip to the west, Mackenzie left his assistants to carry on the work, and at the end of January 1802 returned to Madras ;

One Principal Object of the Survey being now completed (excepting a part of the Outward Boundary of Colar then in Progress, & soon after finished by Mr. Warren), including the General Line of Demarcation obtained by the Partition of 1799, from near the Cauvery at Alambaddy on the South towards the North near Bellary, & thence WSW. generally to the Toombodra near Honelly & the Borders of Bednore[3], amounting to 795 miles in length (which had been only supposed 510), together with 24 Purgunnahs...wholly, & part of 20 more, surveyed, I made the necessary disposition to avail myself of the Permission you were pleased to grant me of proceeding to the Coast, after an absence of 22 Months on a duty that had with little remission of personal fatigue & incessant application, considerably affected a Constitution already impaired by a course of service of several years on the most detached & distant duties of this Presidency[4].

THIRD PERIOD, January 1802 to October 1803

Mackenzie now spent more than two years at the Presidency working up his maps and reports, whilst the survey was continued by his assistants.

Warren completed his length of the eastern boundary of Mysore by January 1802, and completed the survey of Kolār District by July 16th[5]. During this survey he submitted an interesting report on the gold workings at Kolār[6]. He then went down to the Presidency to finish off his maps and memoirs, and was transferred to Lambton's survey in October.

Mather continued survey westward through the southern and central parts of Mysore, and was indeed the mainstay of the survey; on him devolved the important task of training the boys from the Surveying School [343–5].

Mr. Mather's Survey down to a certain period having been laid before you, it is only necessary here to observe that, having come to the Coast in August 1802 on account of his health, & in the time necessary for that purpose having arranged & completed the Memoirs & Plans of his Survey (in Triplicate), ... after re-establishing his health & equipment he proceeded up to Mysore. ... Having resumed the Survey on the 31st March, by his last Report of 12th June he had completed the Purgunnahs of Nellamunglum [pl. 11] Nidjigull, ... and some progress was made in Chinnaraidroog. ... He is further directed to extend it Westward to meet the Tract under Survey on that side extending along the Southern Boundary of Serah[7]. ...

His Maps of the first 11 Districts on a scale of 1 mile to an Inch & Memoirs and Registers of the same in Triplicate ; with reduced Charts[8] of the whole on a Small scale of 8 miles to an Inch, were sent...in November last, & his Work since that date contained in Plans of the last 7 Purgunnahs are also communicated[9].

[1] DDn. 41, 23–10–01. [2] DDn. 41 & 46, 10–11–01. [3] From 57 H/7, East and north by 57 K/11, west to 57 A/16, then south to 48 N/12. [4] DDn. 42, 12–7–03 (30), & cf. DDn. 41, 27–12–01. [5] Map, MRIO. 146 (32); Memoir, MRIO. M 115, & FD MR. 93. [6] *As AR.* 1804 *Misc. Tracts* (1–7); *JASB.* III, Sept. 1834 (463). [7] DDn. 42, 12–7–03 (47). [8] Maps, MRIO. 133 (44–5), 147 (10); ib. 134 (3), reduction by Morison of Mather's survey round Ballapoor, 2 m. 2 inch, 1801–2. [9] DDn. 42, 1–10–03 (18).

Arthur's work was much interrupted by ill-health ;

Mr. Arthur...was under the necessity of descending the Ghaats again immediately on my leaving Mysore, under the Surgeon's Certificate, & finally to proceed to Sea for the recovery of his health, whence he returned in January last [1803], & has been enabled to resume the survey in Mysore on 20th March on the Purgunnah of Mailcotta [pl. 11] which I directed him to survey as not so immediately dangerous to health, & in pursuance of the plan of filling up the several Districts in succession, & in coincidence with the adjacent Districts proposed to be surveyed by Mr. Mather & Mr. Morison. ... The Actual survey of Mailcotta is reported to be completed on the 21st of last month[1].

By October 1803

he has Surveyed Mailcotta wholly, Kisnarajepoor including about 500 miles by estimation, & he is directed to go on with Periapatam & Narsapoor[2] [pl. 11].

Meanwhile Warren's place had been filled by William Morison[3], who,

after attending the Observatory and my Office here for some time to get acquainted with the nature of the operations, ... & being equipped with Instruments, &c., proceeded to Mysore in October last, where he commenced the survey of Nagmunglum and the Districts adjacent, extending North towards Banaveram[4] (where I had terminated the survey in December 1801), and East towards the Tract whereon Mr. Mather is now proceeding ; my intention being, by taking up these tracts in succession by the Assistants, to accelerate the filling up of this space by several hands working at once towards the Centre, by which means the Country comprehended between the Northern Survey, Seringapatam, and Bangalore, would have been completed in a much less proportion of time, as the Fundamental Points bordering on three sides were already ascertained[5].

Morison reached Seringapatam on 2nd November 1802 & Mackenzie wrote to him ;

I was happy to hear of your safe arrival at Seringapatam, & that everything has occurred so much to your satisfaction, and so favorable to the object of commencing your operations. Your choice of ground...for your commencement has been left to your own judgement, any where within the Districts pointed out for your Survey ; my suggestion of your Surveying the Road from Bangalore by Ootradroog was merely from a view of getting it in addition, without losing any time in going after it ; but, situated as you are now, it can no longer be an object ; I have been accustomed to Survey roads in my passing to or from a place, & it was merely in that light I mentioned it, of taking it in the way had your Perambulator been up in time[6].

Morison showed every promise of becoming a valuable surveyor, being a man of outstanding talent who eventually became a member of the Supreme Council, but he had only been at work about three months when he was recalled to his unit to take part in the Marātha War of 1803–6.

In July 1803 Mackenzie submitted his second General Report with maps and memoirs[7]. He estimated that, of the whole area to be surveyed, viz., 51,650 sq. miles excluding Coimbatore, about three tenths had now been completed;

by himself, ...	7,400
Mather	3,741
Warren	2,071
Arthur	500
Morison	314
the Bombay surveyors in Kanara [I, 132] ..	2,000
Total ..	16,026[8]

The plans were submitted in triplicate, one set for the Resident, one for Government, and one for the Court of Directors, this last copy being lost in the *Prince of Wales* in 1804 [107].

The *Plans* are laid down on a Scale of a Mile to one Inch, chosen as the most convenient for the Provincial Maps, ...wherein...every object of importance, Political or Military, may be conveniently introduced ; these, collected at the end of the Survey into one Body or Atlas [112, 292], will at once preserve & furnish such Information as may be occasionally required.

The *Memoirs* are divided into two parts, naturally arising from the separate Management of the Countries under Survey ; viz. The *Company's* & the *Rajah of Mysore's* ; ... whence a

[1] DDn. 42, 12–7–03 (49). [2] ib., 1–10–03 (27). [3] appointed 25–6–02. [4] Bānēvar, 57 C/3. [5] DDn. 42, 12–7–03 (50). [6] DDn. 66, 11–11–02. [7] DDn. 42, 12–7–03 & Report with map, BM Addl MS. 13660 ; also DDn. 42, 25–5–03. [8] ib. 42, 1–10–03 (49).

body of useful information of the Extent, Nature. & Resources of these Countries may be derived. ... The Population in one is taken by enumeration of Heads by Estimate, in the other by Accounts of Houses & Families from the Register of the District.

The *Short Description of the Districts* are arranged under the heads...circulated to the Surveyors. ...

The Register of *Villages, Tanks,* & other *Waterworks, Stock,* &c., will be useful in assisting Plans of Internal Oeconomy & Management of the Districts. ...

The *Historical Sketches* are abstracted from Written or Traditional Accounts[1].

Copies were also submitted of,

1. Large Map of the Northern Provinces of Mysore, Surveyed in 1800 & 1801, Scale 2 miles to an inch.
2. Particular Map of the Purgunnahs Paughur & Nidigull of Mysore with...the Ceded Districts, necessary for more clearly understanding the Intermixture of Boundaries on that side [92][2]. Scales 1 mile to an Inch.
3. Plan of the Triangles taken & computed as the foundation of the Work.
4. General Map of all the Purgunnahs, ... Scale 4 miles to an inch[3].
5. Book of the Roads surveyed in Mysore, ... 42 Pages.
6. One Volume containing Collections of the Registers, ... Historical Accounts...of the Northern Purgunnahs. ...
7. Remarks on 16 Forts, ... extracted from the Journals. ...

The Outward Boundary of Mysore, reduced from the several Surveys...for insertion in a General Military Map. The same to Mr. Goldingham for insertion in a General Revenue Map.

General military charts...to General Wellesley and to Commander in Chief[4].

Abstracts of Astronomical Observations taken with the survey in 1800–1801, ascertaining the situation of the several points connected with the Primary stations of the survey[5].

On reviewing the whole that has been effected within 44 months by only 3 Surveyors, with the moderate establishment attached, most of whom have been repeatedly obliged to relinquish the work for a considerable portion of that time by the sickness incident to the Upper Country, it is believed that more has been done comparatively in the Geographical part alone, and of a more complicated nature, than has been hitherto effected in the same time in this country. ...

Though the interruptions mentioned...have retarded the progress, ... it is to be presumed that with the knowledge now obtained...what remains may be effected in less comparative time with the same means. ... On this account the employment of a sufficient number of Assistants (four at least), and the immediate patronage and encouragement...of such as distinguish themselves, ... deserve some consideration[6].

The Memoirs included information about the situation, extent, and Boundaries, and contents in square miles of the several Purgunnahs of the Partition of 1799. ...

The population by castes, and Houses (as no actual enumeration by Census can be immediately ascertained). ...

Woods, Jungles, Forests.

The Nature of the Soil, and the gross quantity, cultivated or waste, plain or mountainous, has in some instances been estimated, and it is intended to follow this thoroughly...in all the Districts, so far as practicable without going into the minute details of a Land Survey[7].

Mackenzie further reported that the Southern Boundary & Districts adjacent South of the Cauvery have not yet been attempted for want of Assistants, & as it is conceived that they are less material to be Surveyed for the present[8].

Up to the beginning of 1803 Arthur Wellesley had been commanding the troops in Mysore, and took the utmost interest in the progress of the survey, and Mackenzie writes to Warren in 1801 ;

I am glad that Colonel Wellesley has so favorable an impression of the General design of this work ; I can only say the intentions are sincere on this side to render it as generally useful, and as soon as is consistent with tolerable accuracy ; how far this turns out to satisfaction must be left to others to determine[9].

[1] DDn. 41, 20–11–02. [2] MRIO. Misc. 1–0–06, map illustrating exchange of districts under supplementary treaty of 29–12–05. [3] ib. 3–0–03; a large paste-up map; scale 4 m. to inch. dated 1–5–03, "Northern and Eastern Provinces of Mysore, with the Boundaries of the several Purgunnahs"; see also ib. 132 (8). [4] DDn. 41, 22–2–03. [5] DDn. 42, 12–7–03. [6] ib. 1–10–03 (37). [7] ib. (39). [8] ib. (29). [9] DDn. 66, 21–10–01.

A year later, in submitting to Wellesley maps of the forts and roads[1] [94], Mackenzie writes,

I particularly regret that the Roads are not more numerous. It was my intention to have prepared a Military Chart on a larger Scale after the other Plans of the Survey were given in, but the present requisition for the Public Service rendered it necessary to construct it before the whole Surveys were reduced[2].

FOURTH PERIOD, October 1803 to December 1805

At the end of 1803 Lambton commenced his trigonometrical measurement from coast to coast [238–9], and in October of that year Mackenzie, who was still at the Presidency and fully aware of Lambton's plans, writes to Mather ;

You may recollect that before the Institution of the different Surveys the breadth of the Peninsula was much wanted [I, 178–9], but in the Spherical Trigonometrical Survey it appears still not effected ; while our Surveys being confined to the N. and E. Boundary & Districts, it was not yet within our reach. I am very desirous of having this closed first by our Survey for early communication to England, & as the Season will be now favorable, & your young men sent to their several Districts [106, 344], I wish you could take an early opportunity of carrying on your Series of Triangles...till you lay hold of some stations on the Ridge of Ghaats, that may be afterwards connected with the Surveys on the other Coast. ...

I do not think it would take much time, & it would give me great satisfaction if it was effected before Major Lambton & his two Assistants carry them to that side...— *do not mention this to anyone whatever, as I confide absolutely in yourself alone*—it was always in my contemplation had I gone up earlier ; but as I have not yet got my own situation remedied [330–1], I cannot go up this fortnight[3].

Again about three months later ;

If you could connect Mangalore Flag Staff...it would be extremely desirable, as I should be happy to have the breadth of the Peninsula determined by our Survey twelve months before the other [238, 241]. If I had your computations of these Triangles now, I would transmit them directly. Observe for the Variation at the Base, & I could write you to observe the Latitudes ; if you are not accustomed to take the Stars, you may take several of the Sun at noon or by equal altitudes. ...

On comparing your Stations with Major Lambton's so far as the latter go, a very near agreement prevails. ...

If you can take it [Mangalore Flagstaff] by a sudden journey well prepared, setting your Assistants to their work in your absence, it would be extremely desirable ; for 43 miles I suppose 10 days would suffice going & coming. I would in this case recommend particularly your not mentioning your intention till you actually out it in execution ; you cannot imagine how these things get wind, & are magnified or misrepresented in the reports circulated ; you need not therefore be surprized that I am desirous of having it first reported officially by ourselves[4].

In April 1804 ;

I am much pleased with your account of the progress in the Base [*inf*], and hope by this time you have begun your journey to Mangalore, as I am anxious to have that object over by the time I arrive with you, when we will concert measures for the ensuing operations[5].

There is no record of the achievement of this enterprise, nor does Mackenzie ever claim to have anticipated Lambton's measurement of the breadth of the peninsula.

In December 1803 Mather reports that ;

Although my operations have of late been considerably retarded through the whole of my Party being less or more afflicted with the fever & ague (from which I am not quite except), I yet entertain no doubt of closing in the Triangles, which will include...one or two stations on the Western Ghauts, ... in the course of this month. ...

The very sickly state of Benjamin Ward and William Howell and several of my followers, induced me to send them on to Chiteldroog for medical aid[6].

To Mather's latest plans Mackenzie replies ;

As a new Base will now be necessary, not only for verifying the triangles from the East, but to serve as a foundation for extending a series of stations more correctly for surveying the

[1] Large scale plans, Kolār, Harihar, etc. MRIO. (1). [2] DDn. 41, 23–10–02 ; various maps of roads, MRIO. 151 (2–78) ; 152 (1–85). [3] DDn. 66, 23–10–03. [4] ib. 23–1–04. [5] DDn. 43 (51), 4–4–04. [6] From Mather, 6–12–03 ; BPC. 26–7–04.

districts South and North of your present field of operations, & as it does not appear that the Spherical Trigonometrical Survey has yet been extended into that Quarter, or can give any aids to the Survey of the Western limits near the Ghauts for some time, & which now admits of little delay from the approach of the hot season, I therefore approve of your suggestions of measuring a new base in any convenient level situation[1].

Again in April ;

I duly received...your account of the method followed in measuring the Base near Azimpoor[2] [pl. 11] ; the near agreement of its triangles with those of the former base is very satisfactory. As I am desirous that its marks should be kept clear till I go thither myself, I hope you will take care to have its extremities marked by stones, and request the Amuldar to prevent the line from being destroyed or ploughed up for at least one season.

As the progress of the survey south will bring you gradually towards the limits of Koorg, which requiring more than usual delicacy, ... I have to request your particular attention not to carry any operations of the survey into that Rajah's districts, nor to maintain any intercourse with its inhabitants until authority is received. ... You had better not carry any Stations into...those Districts that may immediately border with Koorg[3].

Meanwhile Arthur was surveying the south-western districts of Mysore, and Mackenzie writes to him in October 1803 ;

I wish you at the first opening of the fair weather to extend your Triangulation as far as you conveniently can towards the Western limits in the Parallel of your present work, as a means of accelerating the Survey in that direction while the fair Season admits. ...

The course of the Cauvery & Himawatty[4] will in this respect be a useful direction to your work, & your notices of the origin and course of these & other rivers & any uses that may be derived from them, & the effect of the periodical rains in their rise and fall, will be an useful addition to the observations which I see with satisfaction in your journal[5] [107, 115].

And again ;

In consequence of your application...requesting...orders about the Survey of the Boundary with Koorg, having communicated the same to the Resident of Mysore, ... it is not intended you should survey the boundaries of that Country[6].

Mackenzie was particularly anxious to keep Arthur away from the frontier districts because he had been reported for indiscreet behaviour on more than one occasion [367–8], and at the Resident's request he was directed to fill in the area east of Melukote[7].

During 1804 the work was steadily extended towards the west ;

The Eastern and Northern Districts of Mysore being completed, & a considerable part of the interior in progress Westward, I had it in view to complete the whole Western tract lying along the Ghaats during the fair season, preparatory to which I directed the two Assistants to extend the Stations early in that direction, that we might enter on the detailed survey in concert, & thus join the whole to the central parts in one season. ...

I suggest employing some of the more experienced of the young men educated at the Surveying Seminary for a time, until the whole of the Boundary with Koorg & with the Company's immediate possessions in Malabar, Cannanore, & Coimbatore, were complete[8].

In October Mackenzie wrote to Mather ;

In carrying the Survey along the Outward Boundary with the Company's Districts, you will as usual observe and notice the permanent landmarks, and where doubts or disputes may exist give notice to me thereof. The Teak and Sandal Woods in that quarter will also be a particular object of your attention, and to estimate their extent, quality, &c. ; so far as may be consistent with the health of your party, your observations on these Woods will be conducted with your usual discretion[9].

He did not himself go up to Mysore till June 1804, and six months later took up the survey of the Coorg frontier, in company with a mission that was to settle various disputes ;

Previous to my being apprized of any disputes of this kind, I had in the progress of the work directed the assistant surveyors to extend their Preliminary Triangles to the Westward ; and in consequence the survey of the Districts...already executed furnished sufficient foundation

[1] DDn. 43 (34), 22–1–04. [2] Measured by Mather, March 1804, and re-measured by Mackenzie, Sept. 1805 [107]. [3] Map of Mysore Taluk, etc. by Mather, 1804 ; MRIO. 132 (5). DDn. 43 (52), 29–4–04. [4] Hemāvati R. 48 O/12 to 57 D/1. [5] DDn. 43 (12), 24–10–03. [6] ib. (27), 19–12–03. [7] ib. (61), 9–5–04. [8] ib. (32), 30–12–03. [9] ib. (78), 17–10–04.

for extending those of the Boundary...towards Koorg. ... It remained to take the same measures in the Districts adjacent to Koorg on the North. ... To avoid premature discussions or surmises productive of uneasiness, as it was esteemed a matter of delicacy, the Assistants were directed...to avoid touching on the disputed tract till the survey was actually authorized. ... On account of the rainy season and the danger of going too soon into the unwholesome damp foggy air of the Western Forest, it was agreed on to be protracted till the season was sufficiently advanced to permit of entering on it with safety.

Being acquainted of the Mission...about the middle of January [1805], on 17th I left Mysore, and proceeded with Mr. Mather and our respective establishments to resume the survey of the Western Districts, and to be at hand as occasion might require. Mr. Mather proceeded to survey...while I went more circuitously...to ascertain the stations on that route. ...

The Field Work of the Boundary commenced on the 2nd February, ... and was continued unremittingly to its conclusion at the Southern extremity on 12th March. ... In addition to the primary object of the Settlement of the North and East line of Demarcation of 134½ miles, the following results may be deduced from this survey ;

1st. The square contents of Koorg proper...—from the medium of its length from South to North, 57½—and medium breadth from East to West, 29½—1,696¼ sq. miles.

2nd. The connection of its principal points being fixed with the primary stations of the Mysore Survey, a basis is established, by extending a detailed survey at any convenient time thro' this secluded region to the Company's possessions of Malabar. ...

3rd. ... A more thorough knowledge obtained of its avenues on the North and South sides, and of its climate, soil, productions, etc. ...

In the course of this work considerable advantage was found in the increasing experience of the Company's apprentices attached to my establishment, three of whom, with one of my own, were usefully employed in the detailed work [104][1].

In discussing the disputed boundary, the British Commissioner says that he had found that in 1792

the frontier of Coorg connected with the Sultaun's territories was defined by actual survey, two Gentlemen having been deputed by the then Supreme authority in Malabar to effect that object[2]. For a copy of the frontier as laid down by those Gentlemen I have written to Mr. Warden[3], which if I receive from him...as little will remain to be done, ...on that head, but that Major Mackenzie should verify it[4] [I, 131].

In reporting on the settlement of the boundary, John Malcolm, who was now Resident in Mysore, forwarded Mackenzie's

complete memoir, with annexed Map, ... and from these Documents his Lordship in Council will observe that the public service has...derived the greatest benefit from the zeal & ability of that distinguished officer[5].

In April 1805 the survey reached Bednur [I, 125 ; II, pl. 11], and Mackenzie wrote to Mather ;

It being desirable that as much of the country of Upper Bednore bordering on the Western Ghauts should be surveyed as the weather may permit before the rains set in, and as you have already established a foundation by the operations last year, I have to request that you will proceed with all possible dispatch, to include as much of the country as possible before the rains set in, and to extend your primary stations also. ...

As I propose proceeding thither myself very shortly to Superintend in person the execution of this part of the Survey, you will in the meantime proceed on the former principles adopted, of taking districts alternately bordering on the Ghaats...by which the limits of the whole will be sooner obtained, and the remainder may be readily filled up at a future opportunity[6]. ...

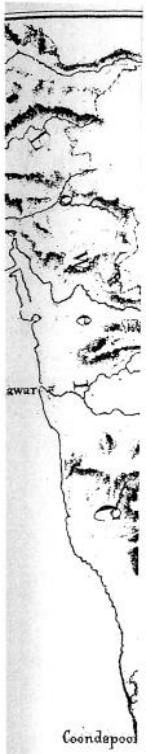
I could wish the scale for Bednore to be one mile to an inch, admitting of the features of the country more distinctly ; to which I wish you to direct for particular attention from the young men ; as they are now tolerable acquainted with this, it will scarcely take them more time[7].

He sent a special report to the Governor General at Calcutta ;

In the course of this last year, such considerable progress has been made towards termination of the Mysore Survey, that it may be readily presumed that the Geometrical Survey of the Ballaghaut Provinces [93 n.1] of Mysore may be concluded in the next year, and such parts of Coimbatore and Canara as are not surveyed already. ...

For the purpose of stimulating every possible exertion by personally inspecting & sharing its labors, I left Madras in June 1804. ... Since that time I have been without intermission

[1] Memoir, DDn. 44. [2] No record found, but Emmit was probably one. [3] Sec. to Govt. of Bombay.
[4] DDn. 68 (338), 18-1-05. [5] ib. (359), 25-3-05. [6] DDn. 43 (94), 11-4-05. [7] ib. (98), 1-5-05.



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employed on Field Duty in the South Western parts of Mysore, directing the Work and executing a considerable part of the Geometrical Survey ; and it is satisfactory to me now to observe that under so long a continued exertion under the vicissitudes of climate and season peculiar to this country, the Parties employed have been enabled without casualty to carry it to the extent more particularly stated herewith. ...

Together with the internal Geometrical Survey, the whole of the Mysore Boundary is now ascertained, excepting a very small portion with Wynaad[1], & that of Soonda & part of Bednore to be done next season. In the last year the litigated Boundary with Koorg was minutely surveyed. ...

The elucidation of the History of the several Governments that have rapidly succeeded in this State will, I conceive, be very interesting as, by the Inscriptions, Grants, and other documents that came into my hands, a regular progress is traced up to the first Muhammadan invasion in the 13th century, and even beyond it to the 8th, but more obscurely [355]. ...

The Military Part of the Survey has been less minutely attended to from the want of any Military Assistants ; yet some of the young people from the Company's Seminary have been instructed on the method of describing Rivers, Defiles, etc[2].

In August 1805 Mackenzie lost his last military assistant, Arthur being removed at the request of the Resident, who had received further complaints from district officials [105]. Extracts from Arthur's journal for 1904–5 are given later [208, 312].

In September Mackenzie remeasured Mather's base-line at Ajampur in Shimoga District[3] [104] and in November reported that,

in order to prepare...copies of the Documents of the survey lost in the Prince of Wales [102], I immediately sent for such of the originals and fair copies as had been deposited at Madras and Seringapatam, which I directed...to have...copied off, in addition to the surveys since done, which in the interval had increased to double what had been reported on 13th July 1803.

The increase of duty from these demands...induced me to remain at Simoga[4] during the rains, as a healthy station where I could with more advantage employ the united efforts of the establishment while the sick were recovering ; on the first appearance of a change of weather I proceeded to survey some of the Eastern districts of Bednore, and then to Adjampoor, as a central situation where, with the necessary operations depending on a verifying base measured there, I proposed on the arrival of the documents from Madras to combine the latter surveys with the general map already executed.

On their arrival, ... I conceived it more conducive...to the order of the Honorable Court of Directors...directing the survey to be concluded as soon as possible, ... to proceed to survey the remaining part of the Northern and Western quarters of Bednore. I therefore detached one of my assistants [Mather]...with a surveying party into the districts of Cowlydroog...and Anantpoor, and I am now proceeding with the remaining part into the districts of Honelly [pl. 11]...& extending towards the North Western Ghaats[5].

To Mather he writes ;

I have been extending my Stations on this side to the first two Hills from my Base at Hurryhur in 1800 [95], ... and the difference is only 180 feet, which in the Base would be probably only 69 feet ; it is also probable I may reduce it still further ; this gives me great satisfaction in closing these parts of the work together[6]. ...

I am happy to find you are going on so rapidly with the Survey ; the method and time is entirely at your own disposal, so continue to take your own measures, but I could wish you to be particular in laying down the great features of the Country & the sources of the rivers when you come to any, if any rise near the Ghaats in these districts.

We have not got on so rapidly here as I expected ; not owing to any want of pains or labour, but it becomes necessary to lay down the preceeding two Districts before I enter on more ; it is however near a conclusion now[7].

Early in 1806 the whole survey moved down the Ghāts westward into Kanara.

[1] Wynād ; an old subdivision of Malabar District, 58 A/NW. [2] DDn. 43 (121–2), 25–6–05. [3] Memoir of Mather's base, Sept. 1804, and Mackenzie's, Sept. 1805, MRIO. M 140 & 50. [4] pl. 11, *Seemogga*. [5] MPC. 13–12–05. [6] DDn. 43 (140), 12–12–05. [7] ib., 16–12–05.

CHAPTER VIII

MYSORE—(*Contd.*)

Survey of Canara & close of Mysore Survey, 1806–7 — Natural History & Botany — Relations with Lambton.

THE present districts of North and South Kanara were ceded to the Company in 1799. They were for some years occupied by Bombay troops though both were administered from Madras until North Kanara, first known as Sonda, was transferred to Bombay in 1861. Though Moncrieff and his assistants had already made a rapid reconnaissance survey [I, 132], Mackenzie included both provinces as his responsibility[1], and writes in 1803 ;

The Canara Province, & probably part of Lower Soonda [92, pl. 11] appear from Maps communicated to have been surveyed by the Bombay Officers, but the Documents on which these Surveys have been founded do not accompany, & it is much to be regretted that the idea of one General Systematic method is not followed by the different Surveyors, as laid down for this Survey, which would have the important effect of more accurately combining the labors of the different Surveyors & sooner completing the Survey of the whole Country.

In the Western Maps no notice appears to be taken of the Woods which are said to be of importance on that side [167], & it is therefore doubtful whether these tracts are embraced in the Surveys[2].

Johnson's survey of Sonda in 1801 having fallen through, [96-7] Mackenzie did little in that direction, but early in 1806 took up the survey of South Kanara, sending one party under Mather to work northwards from the south, whilst he himself worked southward from the direction of Honāvar. He writes to Mather from Shikārpur [pl. 11] ;

When you come to the Western side...I wish you to take the Angles of as many conspicuous objects as possible in the Lower Country while the weather is fair, as it will facilitate the establishment of Stations there, should it be necessary. While you are at Cowlydroog[3], a Sketch plan of that Fort might be taken by the young men, & I will thank you to have its principal Points...inserted[4].

and later, from Gersoppa[5],

I do not think it necessary, in the present circumstance of Canara being under the Management of our Government, to Survey the interior limits of these Districts, & for the present you have to ascertain the Outward limits only ; South with Malabar, & East...along the Ghaats on the points where they are accessible.

By the time your Survey extends North to the present limit of the Southern Division of Canara, you will receive directions whether it is to be Surveyed or not ; at present I am desirous that you should extend your Survey gradually from the South Extremity towards the North, as the Survey from this side will be extended towards it, and the intermediate Districts can be taken by the party first approaching. ...

You have my permission to go to Mangalore whenever your health or business may require it[6].

To the Resident of Mysore he reports, from Honāvar, the survey of the greater part of Bednore...towards the Ghats[7]. From the peculiar nature of the Country, it is extremely difficult to survey minutely, but tho' in fact it embraces little of any valuable land, yet, as forming the natural boundary with Canara, it becomes desirable...to take this opportunity of including it with the Survey. ... The Ghaats where I descended lately...to Gersoppa approach within 12 miles of the Sea, but are nearer in some other parts. ...

[1] *Plan of the Mysore Survey* [91–2]. [2] DDn. 42, 1–10–03 (30). [3] Kavaledurga, 48 O/2. [4] DDn. 43 (145), 10–1–06. [5] Gersoppa Falls, 825 ft., 48 J/12. [6] ib (156), 1–4–06. [7] "Map & Memoirs of Western Borders, 1805–6 " MRIO. M 125.

I hope to have the opportunity of connecting my Stations with several points on the Sea Coast, but by a circuitous mode, as [owing to] the Fog & haze already prevalent, and the superior height of the Ghaats from the Summits already ascended, we could seldom distinguish any well defined points of the low Country, excepting some Islands on the Coast, until the Series could be carried by the hills forming this valley to the Sea.

I trust, however, before the rains begin that the whole line of Western limits along the Ghaats, & a considerable part of Lower Canara, ... will be completed[1].

Again to Mather in May, from Coondapoor,

I wish you had early attended more to the Plan laid down...in my Instructions. ... You were then acquainted of my intentions of executing rapidly as much of Canara as could be done this Season, by employing parties from its North & South Extremities to meet towards the centre, & for this purpose I had myself proceeded from Honore, [intending] when I descended the Ghaats northwards to have carried it gradually Southward[2], and I expected that your party would in like manner have proceeded on your Series of Triangles to the South Extremity, & thence worked Northward. I have, however, no objection to the method followed, provided your returning over the same ground may not occasion any part to be left undone by the loss of time[3].

and from Mangalore,

I arrived here on 17th, & as the S.W. monsoon may be expected to set in soon, I am desirous of having all the Surveying parties collected & withdrawn from Canara as soon as possible[4].

Mather had been in poor health for some time, and now asked leave to resign;

Owing to the heavy rains in the low country, the having my charts and baggage to transport across a country almost under water, the want of boats to cross the river, and above all the sickly state of my people, I was prevented from reaching this place [Belur][5] till yesterday ; and after all my anxiety about these poor fellows, whom I could not think of leaving exposed to distress and probable inattention, I have been obliged to leave some of them below the Ghauts. I have travelled the whole way in the rain, which has operated much to my disadvantage, and even here the monsoon is allowed to have set in some time ago.

The accompanying letter, which I request may be transmitted to Government, fully explains my present situation, and nothing but the prospect of going down to the Western Coast, and the hopes of benefitting thereby, prevented my applying to be permitted to relinquish the survey when at Nuggur[6] ; ever since the first attack at Cowleydroog, I cannot say that I have enjoyed a day's good health, or a night's repose, and from that stroke I have no idea of ever freely recovering ; my native air may be of use.

Since the Rheumatism invaded my limbs so severely, it has almost deprived me of the use of them. By removing into some of the more Easterly Districts of Mysore, and beyond the influence of the monsoon, I might derive some small benefit perhaps.

The survey being so near a close occasions me to leave it with regret, but it's some consolation to think that the young men are sufficiently experienced now to complete the field work under your frequent inspection and directions ; and that my absence will therefore be the less felt. I have endeavoured to do every justice to the survey while engaged on it, and now while unable to follow it up with sufficient activity, and give it full effect, I think it highly improper to hold a situation which can only be considered nominal, and that too attended with a considerable expence. ...

The remaining memoirs wanted to complete last year's surveys are in hand, also fair copies of the Districts lately surveyed[7].

Mackenzie appears to have been more concerned at the prospect of losing Mather's services, his mainstay for the last six years, than he was at his ill-health, and he urged him to stay and see the maps completed ;

It was my wish at the close of the work executed since November last to have the results brought up at some central place, while some attention was meantime paid to fill up the remaining Districts at any favorable opening of the weather, as was done in former years. Your case rendering it necessary for you to proceed Eastward immediately, the two young men recently come in shall wait only till I have your answer, as I judge they will be necessary for you in Copying off or revising the work on which they were employed with you[8].

[1] DDn. 43 (159), 13–4–06. [2] Map ; *Canara Province, Honavar to mouth of Kolloor Nadi*, [Kollur N. 48 K/10], 1½-inch scale ; April–May 1806 ; MRIO. 146 (5). [3] DDn. 43 (162), 7-5-06. [4] ib. (164), 20–5–06. [5] 48 O/16. [6] Nagar (Bednur), pl. 11. [7] Map ; *Plan of part of Barcoor* [K/11], 1-inch scale, J. Mather, 20–5–06 ; MRIO. 134 (5). MPC. 8–7–06. [8] DDn. 43 (169), 20–6–06.

He wrote to Government;

The delivery of the materials...might as well be done at the Public Offices at Madras as in Mysore. The fair copies and reductions of his plans may be executed, certainly, as he suggests, at my Office, when the state of the survey will permit of its being fixed or stationary and of withdrawing the Sub-Assistants for that purpose; but the original plans, field books, and documents, should be previously revised...under his own inspection. ...

Of the Rajah of Mysore's Country, the interior of the two districts of Sirah and Bangalore, and some detached portions of a few others of no great extent, only remain now to be executed, ... and I have remained here since the 11th instant only with the intention of recovering the sick, and of bringing up in the rainy weather several details of our late surveys, previous to detaching a party to Serah, when I proceed to the southward and eastward to complete in my way the portions wanting, which during the rainy season may at fair intervals be attempted on that side without much difficulty.

In addition to the whole nearly of Bednore, or the N.W. part of the Rajah's Dominions, the Northern Division of Canara and part of Soondah has been completely surveyed by the parties with myself since the beginning of April last. The most considerable part of the southern division of Canara appears to be geometrically surveyed by Mr. Mather's party; but...the customary accounts of the state of these Districts...appear to have been omitted[1].

After completing his maps and reports at Bangalore, Mather left for the Presidency early in September, leaving the young assistants to fill up various gaps on the plateau[2]. Mackenzie was now

the only European Officer engaged on this Service; ... since June last the Assistant most considerably employed in the Geometrical details has withdrawn; & for twenty seven months the Medical Assistant has been from ill-health absent [115]. ...

The number of Native Sub-Assistants & Apprentices at present attached are Five from the Surveying Seminary, Natives of European Parents, & one, a private servant of mine[3] [156].

In January 1807, he sent Ward, Summers, and Lantwar, to survey the Company's districts of Punganuru and Ambur[4] on the eastern frontier of Mysore, and Dunigan and Howell to finish off Kanara, writing to the Collector;

I am very anxious to have this corner completed &, with regard to the other Districts to the Eastward, it will depend much on the celerity with which this comparatively small part is done; but, whether that be attempted this season or not, for the more expeditious closing of South Canara I send the young men who actually had done the former part last year. ...

I proceed myself shortly to the Eastward to get Poonganoor...&c. surveyed, as the 3 Districts there only remain to complete the Survey up to the Ghaats on that side, while Canara completes it to the Western Sea. I have thoughts of going then to the Presidency. ... We have now the whole of the Mysore Rajah's Territories completed in detail[5].

Dunigan was given the following orders;

On the stations carried from...the Western Ghauts, etc., to Mangalore and the sea coast, you will carry the few primary stations that are now requisite to Mount Delhi[6] on the coast. on the South, and on the North to the points of...Coondapoor, Boulydroog, etc. ...

You will on your return from Mount Delhi to Mangalore complete the measurement of that Road, and any part that is wanting to complete that from Mangalore to Cundapoor.

On your arrival at Mangalore you should be careful to adjust the channel of receiving and sending your letters, which I conceive may be done with facility by proper notice as usual to the Ports along the coast, by your leaving directions at Mangalore, Coondapoor and Nuggur. ... This I have to direct you will pay particular attention to, in order to prevent the very great inconvenience and loss of time that occurred last year, for want of keeping up the regular correspondence with me. On your applying to...the Postmaster in my name, he will readily render you any assistance in forwarding and receiving your letters, and [I] will direct mine for you, to his care[7].

Again at the end of April;

I am happy to understand you have completed the South part of Canara; and doubt not but the remaining part of Barcoor and Nuggur will be fully completed before 1st June, when you know that it will be impossible to remain below or near the Ghauts to survey. Let me therefore request you to expedite Barcoor [pl. 11] as soon as possible, and to ascend the Ghauts even without waiting to protract it.

[1] MPC. 8–7–06. [2] Map; *Purgunnah of Bangalore*, Sept.–Oct. 1806, M. Dunigan. MRIO. 146 (1) DDn. 43 (176), 27–6–06. [3] ib. (218), 3–3–07. Dunigan; Ward; Hamilton; Summers; Howell; Lantwar. [4] Fdbk. Feb.–June 1807; MRIO. M 58. 57 K/11; L/9. [5] DDn. 43 (209), 19–1–07. [6] Mount Delly, 48 P/4. [7] DDn. 48, 10–2–07.

There is another object I wish you to complete at this opportunity ; that is a plan of the Fort, Town, and Environs of Bedenore [92 n.3], comprehending all the public and remarkable buildings and places within the Bound hedge, the Barriers, Gateways, Futteepett, and all the Environs on the same scale as that of Bangalore.

When this and the District of Nuggur is done, you can return by Coppa[1], and take the few villages wanting of that quarter ; and, if you could contrive to visit the Heads of the Goom and Budra[2], it would be very satisfactory to me to have a minute and detailed description of them. ... Observe particularly the state of the water there, and the dimensions of the head springs, breadth, depth ; enquire of the most intelligent Natives of the commencement and duration of the different seasons, Rainy or Dry, and by what circumstances attended [115]. ...

I trust you will be able to close these remaining parts before the Monsoon sets in, as it is my wish you should then set off towards Bangalore and Colar to join the parties on this side[3].

The whole coastal strip between Malabar and Goa was completed, and only Sonda was left unfinished[4]. The completed maps shewed

nearly every village, ... the exterior boundaries of Canara...with the province of Malabar, with Koorg, the districts of Bednore, and the Portuguese Territory of Goa ; and the interior limits of the divisions with one another...also added.

The district of Banawassi, part of Soonda [pl. 11], could only be surveyed at that time on account of the climate, the heavy rains and succeeding fogs, with the woody nature of the country, precluding survey for the greater part of the year ; the circuit and limits of Bilghi were only then ascertained on the same account. ...

The lists previously furnished by the provincial officers from the records of each district were found of great utility on the survey, by enabling the surveyors to verify nearly every individual place, the actual positions of which are inserted by their bearings from each other or from some fixed stations [213]. ... Detailed descriptions of the boundaries were also added, which, with the enumeration of houses, families, castes, tanks, nullahs, and other information furnished from the Cusbas in the course of survey, were included in the memoir of each district[5].

In May Ward was sent to complete the survey of Denkanikota and Alambadi districts to the south-east [pl. 11], that Mather had been unable to survey, and Mackenzie accompanied him before moving down to the Presidency in June ;

My rapid journey to Allambaddy was directed principally to a personal inspection of that tract, while under survey, which has been represented in such unfavorable lights as to deter the party I had directed to survey it...early in 1800 [100]. ...

To arrange such a various mass of materials as this Survey since 1800 has afforded, would have derived advantage from being finally digested in the country that is the subject of investigation, from the readier access to further information, and even correction, but...the necessity of taking early measures to furnish for Europe a General Map & Illustrations, ... from the desire of replacing the total loss at sea [102] of what had been compiled 4 years ago,...will... point out the [need] of attempting to fulfil these duties on the coast[6].

In February 1808 his last maps are reports were completed and sent home[7] ;

The map now laid before the Hon'ble Court has been formed from actual survey, and comprises...41,060 square miles, which will be accompanied...at an early period by the Memoirs descriptive of the Districts which have been surveyed.

The Hon'ble Court of Directors have been already informed of the great attention which has been given by Major Mackenzie to the study of the ancient History of this country, and in pursuance of that plan that officer has presented...to the Hon'ble Court a M.S. Volume containing a register, specimens, & Translations, of Inscriptions, Grants, & Ancient Monuments, & affording very valuable information on subjects connected with general knowledge & science [2, 107]. ...

The merits of Major Mackenzie have been so frequently, and so warmly, represented, ... that the Governor in Council can add no stronger enconium to what has been already deservedly bestowed, but he is satisfied that the farther proof now afforded of the indefatigable zeal & Talents of that officer will not fail to obtain that public attention which it appears justly to merit[8].

Mackenzie had been much bothered by the restrictions of tight financial control,

[1] Coppadroog, pl. 11. [2] Bhadra R., 48 O/4–9. [3] DDn. 48, 28–4–07. [4] *Memoirs of Survey of Canara*, ... by W. L. Lantwar. MRIO. M 142 C. 1806–7. [5] to Board of Revenue, DDn. 83, 14–3–09. [6] to Resdt. in Mysore, ib. (233), 4–6–07 ; *Report...on Mysore Survey*, Madras, July 1807 ; BM Addl MS. 14380 (24). [7] M to CD. 29–2–08. [8] General maps, scale 12 or 24 m. to inch ; MRIO. 132 (9) [pl. 11] ; 138 (44, 47, 48) ; Misc. 3–0–07 MRO. map 204.

and especially by the reduction of allowances ordered by the Directors in 1801, which prevented the employment of further military officers [330–1]. He refused however, to desert the work himself, and declined several offers of more lucrative employment ; "I never considered it out of danger of being left incomplete"[1].

The stringent orders for economy at the end of the Marātha war were accompanied by the recall of Marquis Wellesley, and in 1807, Sir George Barlow, who was acting Governor General, wrote to the Madras Government suggesting the curtailment of Lambton's and Mackenzie's surveys ;

In Bengal several very useful surveys have been suspended until the state of the Public Finance shall admit of the appropriation of funds for their prosecution [12, 60]. Adverting to the extensive information which must have been already obtained by these surveys, they might be suspended or limited[2] ;

to which Madras replied that the Mysore Survey would be completed in the current year when its whole expense would cease. This was somewhat premature, for Mackenzie required another year to finish his detailed maps, in spite of being warned that

the particular desire of the Governor in Council to bring that work to an early conclusion has been exclusively founded on those considerations of public economy which have imposed the unavoidable necessity of making every possible reduction in all the departments of the public Service, and the Governor in Council observes with satisfaction that you have evinced...a commendable attention in limiting the expense of the work. ...

It appears from what you have at present stated that you expect to furnish your final Report regarding the survey in October next, and...all expenses connected with it should cease from that period[3].

In submitting his final maps, scale two miles to an inch, Mackenzie put them forward as the start of an atlas of the south peninsula [102, 276] ;

Whatever defects or merits may be found in this attempt at the Improvement of Indian Geography can attach solely to this work itself, as no part whatever, either in its Ground Work or materials, is borrowed from any other [121]. The Plan & Mode of Execution of the Survey is inserted among the Papers now transmitted [91–3], & from the materials furnished by the labors of the Surveyors employed on it. These maps are reduced from the Original Surveys, conducted on a Series of Stations established by the Assistants in the Several Districts respectively surveyed by each ; & collated with a Series of Trigonometrical Stations carried throughout the whole by myself, of which a Particular Plan & Memoir shall be transmitted, comprehending the whole extent of the Mysore Survey. It becomes unnecessary therefore to send a Copy of the Charts lost in 1804 in the Prince of Wales, as they comprehended only a part of what are now included in those...here referred to[4] [102].

This achievement was a magnificent success, and entirely due to the sound planning, organization, and perseverance of its Superintendent. On this model he based the series of methodical surveys which were spread over the Madras provinces during the next 25 years, and which had the further advantage of being directly based on Lambton's trigonometrical survey. It is to be noted that Mackenzie's account above makes no mention of Lambton's triangulation and, indeed, he made no attempt to connect his work to Lambton's triangles after once satisfying himself that there was but little discrepancy between them [3, 119]. There is therefore no justification for Blacker's statement to the contrary, contained in the following appreciation ;

The Map of Mysore is deservedly a model of topographical Survey, and such as might have been expected from the highly respectable talents employed on it. Its foundations are the great Trigonometrical lines established by Col. Lambton, on which depends a minor net of Triangles, and referring to them, the topographical features of the ground. Colonel Mackenzie took a share of the practical operations himself[5].

In attributing its success to the individual talents of the officers employed, Blacker is again misleading ; the great success of the survey was due to the sound lines on which it was directed by Mackenzie ; for the first season he certainly left the detailed methods to Warren and Mather, but the methods which eventually prevailed, and which largely influenced subsequent surveys of the Presidency, were those worked out between Mackenzie and Mather.

[1] DDn. 43 (251), 29–7–08. [2] MPC. 7–10–07. [3] DDn. 68 (140), 17–8–08. [4] DDn. 43 (259), 18–10–08. [5] DDn. 204 (170), 12–7–25.

The defeat of Tipu Sultān opened up the whole Mysore plateau above the Ghāts, which had an entirely different climate and character to the Carnatic districts. In the first orders given for Mackenzie's survey the Governor General directed that he should be accompanied by Dr. Heyne, the Company's botanist on the Madras establishment [91]. He gave orders at the same time for

the Sultan's garden[1] at Bangalore to be appropriated as a botanical garden, under the exclusive management of Doctor Heyne, ... as a depository for useful plants sent from different parts of the country. ...

A decided superiority must be given to useful plants, over those which are merely recommended by their rarity or their beauty, and it will be Doctor Heyne's primary care to attend to such as may furnish any facility in the supply of food or forage ; ... to collect with care all that is connected with the arts and manufactures of this country, or that promises to be useful in our own ; to give due attention to the timber employed in the various provinces of his route, and to the possibility of introducing the growth of useful trees into such of our provinces as are deficient in that necessary produce, and to collect with particular diligence the valuable plants connected with his own immediate profession [I, 376][2].

In 1800 he further appointed Dr. Francis Buchanan to investigate "the state of agriculture, arts, and commerce, in the dominions lately acquired from Tippoo Sultan". Buchanan reached Seringapatam in May 1800 and, after touring through Mysore and corresponding with Mackenzie, he moved on in November to tour through Malabar. His account of *A Journey from Madras through the Countries of Mysore, Canara, & Malabar* was published in London in 1807[3].

In his "Plan for the Mysore Survey" Mackenzie proposed

that to Dr. Heyne [I, 350]...the Branches of *Botany*, *Mineralogy*, and *Natural History*, may... be assigned, whose employment, talents, and ardour for prosecuting the improvement of these useful branches of service early pointed him out as one who might be well employed acting with me in the Nizam's country, and now still more so in a Country now intimately blended in its interests with our own Provinces.

His reports...will communicate considerable light on the Natural History of the Ballaghaut [93 n.1], and when his time can occasionally admit, I shall expect a considerable degree of assistance from him in the other parts necessary for elucidating the Statistical account of Mysore[4].

Heyne left Madras in March 1800, taking with him an establishment which included,

One European Draftsman or Painter. ...

Two native painters, or Draftsmen, of Plants.

Two Plant Collectors, natives accustomed to this service. ...

Three peons and Harcarrahs for preserving & carrying minerals, plants, and other objects of Natural History[5].

After a few weeks at Bangalore he reported that,

Some days after my arrival here, the Sultan's Garden was given up to me, which since my return from Seringapatam I have endeavoured to put in a condition to answer the purposes mentioned in your letter to Captain McKenzie of 6th February last.

The trees & Plants brought with me from Madras, as Oaks, Pines, Nutmegs, Cinnamon, &c., I have to report as promising very well, and upwards of 250 different seeds have been sown. ... The extent of the Garden is, according to actual measurement, 41 English acres odd, ... [and] employed in it 20 Gardeners, 2 Mastrees, and a Daroga, paid by the Circar[6] ;

to which Government replied ;

You will only occupy such portion of the Garden at Bangalore as may be sufficient for the purpose of a temporary Depot for the Plants which have been sent from Madras, or such rare or usefull plants or seeds as may be found during the course of your tour with Captain McKenzie. ... This temporary establishment at Bangalore is in no respect whatever to interfere with the primary object of your statistical enquiries with Captain McKenzie[7].

Heyne accompanied Mackenzie during his first few months on the north-west frontier, but in October returned to the garden at Bangalore, Mackenzie reporting to the Resident that he had been very troublesome ;

[1] now the Lāl Bāgh. [2] MMC. 4–2–00. [3] Buchanan's Map of Mysore, MRIO. 143 (1) sd. by Charles Crawford ; copy ib. (2). [4] MMC. 11–2–00. [5] ib. 6–11–1799. [6] DDn. 41, 4–5–00. [7] ib. 17–5–00.

In short, My Dear Sir, I find that whatever I propose cannot be well received, ever since May last, tho' I had taken much pains about this gentleman's establishment, and his acting with me was at his own repeated sollicitations[1].

The doctor's departure was particularly inconvenient, as the surveyors now moved into unhealthy country [97-8] ;

Had you been here now, perhaps it would have been convenient you should remain in your medical capacity till we were nearer some of the Posts, as Agues are now prevalent in in this part of the country, and we have been obliged twice to recur to Chittledroog for medicines.

Your Botanical Journals, Drawings, and Descriptions belonging to these pursuits, are not immediately wanted, so far as I know, and, as a permanent situation has been assigned in Bangalore for more conveniently lodging your Papers and Collections, they can be more securely deposited there, under your own inspection, till the pleasure of Government is known[2].

In the spring Heyne moved down to the Carnatic to examine "copper mines in Bomrajah's country"[3], and though he reported his movements, he paid little attention to instructions given by Mackenzie, who eventually wrote to the Resident ;

I find that Dr. Heyne has arrived at Bangalore after a circuitous Journey. ... Pray May I take the liberty of asking if you are acquainted with the object of this Circuit, of which I have little other information than a Bill for expences of enquiring after Copper Mines, which I have only countersigned lest I should be supposed hostile to this pursuit, or indifferent to the respectable authority introduced.

Dr. Heyne having repeatedly applied to me for orders and directions, ... I have judged it advisable, now that he has passed me and announced his arrival at Bangalore, to suggest the expediency of his pointing some of his attention to the Country under Survey, provided it does not interfere with other orders[4].

He writes to Warren at the same time ;

I have certainly been very much disappointed in that [help] I expected from one party, where every consideration might have recommended another line of action. The gentleman you mention I have occasion to know is arrived at Bangalore, and, if I may judge from several of his letters, seems not very willing to drop a contention which in the end cannot be very satisfactory to Superior Authority. It is the first time in my life I experienced anything of the kind carried on with such perseverance, and where I feel conscious I deserved another kind of behaviour[5].

To Arthur he writes ;

Dr. Heyne...is now again engaged in a correspondence with me on an old subject : I never knew such behaviour ; he has repeatedly applied for orders, and, when at last he got an answer, he makes shift to decline compliance[6]. ...

I am very much teazed with Dr. Heyne's letters about his orders and directions, and Contingent bills ; he appears to me very desirous of renewing a paper altercation, which I shall certainly not continue long with him[7].

Heyne rejoined Mackenzie's camp in August 1801, but still continued an unaccommodating attitude, and Mackenzie concludes one letter ;

For my opinion of your capacity in branches of which I am so little qualified to speak I can only refer to my former sentiments publicly expressed, that I am sensible that little advantage can be expected in any undertaking where a mutual concert is wanting ; to maintain that has ever been my wish, and...I can give assurance of my readiness still to promote, so far as lies in my power, every part of your labors[8].

Heyne now remained with the surveyors, attending to the sick, till he was given leave to the Presidency early in 1802 on account of ill health. A few months later he was put on a separate establishment. Amongst the reports he submitted whilst attached to the survey were "Meteorological journals from March 1800 to March 1802", and a "Memoir on Copper Mines near the Ongole[9] District in the Lower Carnatic[10]". He published an account of his work in Mysore in his *Tract II*, *Statistical Fragments on Mysore*[11].

On Mackenzie's return to Mysore in 1804 [105], he was given the services of Dr. Leyden as surgeon, with instructions to prosecute "enquiry into the Natural History & Production of the Mysore Country[12]" [92], including ;

[1] DDn. 41, 24–12–00. [2] ib. 23–12–00. [3] *Memoir on the Copper Mines in the Calastry & Venkatgherry District*, MRIO. M 117 ; Kālahasti & Venkatagiri, 57 O/9. [4] DDn. 41, 27–6–01. [5] DDn. 66, 4–7–01. [6] ib. 12–7–01. [7] ib. 16–7–01. [8] ib. 5–8–01. [9] 66 A/3. [10] Heyne's Journals from 27–3–00, MRIO. M 117. [11] Heyne's *Tracts*, see also *FD MR.* (94). [12] MGO. 14–1–04.

1. Botany & Mineralogy, including Remarks on the Trees, Woods, Plants, Minerals, & other productions of the Country. ...
2. The Diseases, or Medicines, Remedies, peculiar to the Natives & to Europeans in the Country. ...
3. The Air, Climate, Seasons, the Periodical Winds & Rains [92, 105] & their effects on the Country & its cultivation.
4. The Soil, Productions, State of Agriculture, Modes of Cultivation; the Waterworks. ...
5. The various descriptions of Natives, their Languages, &c.
6. The Animals peculiar to the Country.
7. The peculiar Manufactures of the Country, the state of Art[1].

The following May, Leyden's health broke down—the Survey was left without any medical attendant—and these special enquiries had to be dealt with by the surveyors.

RELATIONS WITH LAMBTON

The purpose of the following pages is to refute Markham's statement that Mackenzie and Lambton "do not appear to have worked harmoniously"[2], and to show the extent to which they kept in friendly touch with each other, not only during the survey of Mysore, but in later years also.

It is true indeed that towards the end of his life, when harassed by ill health, Mackenzie showed himself impatient with Lambton's persistent efforts to increase the allowances of his staff, and held the papers up for nearly three years, much to Lambton's disgust, but there was nothing personal in this obstruction.

The first test of their mutual goodwill came in 1801 when Lambton tried to get the services of his brother officer Warren. Mackenzie held out against this for some time, rightly insisting that his needs at the moment were the more urgent, but when the first important task was completed, and Lambton was ready with his instruments, Mackenzie graciously surrendered [117, 119].

Lambton's proposals for a trigonometrical survey were first made early in December 1799 [3, 233], when Mackenzie's plans were well forward, and Mackenzie's reactions are expressed in the following letter to Barry Close [91];

Mr. Webbe[3] [233–4] has communicated to me Captain Lambton's Propositions for a Spherical Survey &c., and requested me to mention to you my Sentiments on the subjects, as a private communication, which I do with greater pleasure as it agrees with an idea I have suggested in my Plan of executing the General Survey in Mysore, of having the whole corrected by a Series of Astronomical Observations [92].

Far from interfering with the Surveys as I propose them in this Plan, ... they will be usefull in rendering the whole more complete, if...they are carried on in concert with the Mysore Survey and with the Observatory at Madras. I therefore think that Captain Lambton's proposal merits encouragement, and that the Instruments necessary, which are rare, would... be very properly employed with a suitable Establishment in carrying this design into execution. ...

On considering this subject, my thoughts would take more time than I can spare now, but...they may be of use in elucidating the Progress of our Surveys in India in General (for in one point I cannot agree with Captn. Lambton where he says "that no correct method has yet been used for determining the position of such points" [250])[4]. ...

Captain Lambton's Propositions fall in with what I have suggested regarding the connection of the whole...by a series of Triangles and astronomical observations [92]. ... I therefore thought all that was necessary for me (not knowing at that time of Captn. Lambton's Proposition), to suggest it merely as a thing desirable for its greater accuracy, confining my own operations immediately to what is sooner within our reach by common means. ... I shall be ready to give it every support in my power.

I have had some conversation with him on the subject this morning, and communicated to him my General Plan. His is precisely on the same ground as the Trigonometrical Surveys carrying on in England and France, and which in the former has since 1790 carried the Triangles

[1] DDn. 43 (69), 13–7–04. [2] Markham (73). [3] Josiah Webbe (1767–1804); MCS. 1783; Sec. to Govt. 1796–1801; Resdt. Mysore, Nāgpur, Sindhia, 1801–4. [4] But Lambton was most certainly justified; DDn. 41, 6–12–1799.

to the Lands-end from Hampshire in 1798. The clear pure atmosphere of this climate is much better calculated for observing distant objects, but the want of an apparatus sufficiently correct for a work of its estimation in the scientific world will be the greatest impediment ; tho' I should hope this will be overcome by a person possessed of so much of the ardour and true spirit necessary for the pursuit[1].

A few weeks later Government advised Mackenzie that they had appointed Major of Brigade Lambton...to make an Astronomical Survey of the southern part of the Peninsula, and chiefly of those Countries which are embraced in the general plan of your more detailed survey [233–4].

As this work is intended to come in aid of your labors, and, to enable you to conduct them with greater dispatch, while it is more immediately directed to purposes of general geography, Major Lambton has been ordered to communicate freely with you on every point connected with the great and important object of your mutual pursuit ; and, as from the distinct nature of his undertaking it has not been deemed expedient to place him under your orders, his Lordship has the firmest reliance in that zeal for the public interests, of which you have offered many honorable proofs, that you will conduct your communications with Major of Brigade Lambton with that openness and cordiality which can alone ensure an useful coincidence in your pursuits, and an honorable results to your joint labours for the public benefit[2].

Though he could not delay his survey for Lambton's results, Mackenzie called on his surveyors to co-operate ;

As this work is intended to come in aid of these labours, a free and liberal communication is desired ; you will be pleased, in case of Major Lambton's coming on that duty into or near the Districts you are employed in, to give him every aid of local information, or such other as he may require to facilitate his operations, without retarding your own immediate Survey[3].

whilst to Moncrieff in Kanara [96, 108] he writes ;

It will be an useful work in establishing certain points of connexion, but will of course require time. I am ordered by Government to give him every assistance in my power, and I suppose your Surveyors will be the same. ... I believe it now generally understood that all ...works undertaken for the Public Service are rendered more useful and more correct by reciprocal communication[4].

In September he writes to Lambton regretting that, though he had prepared a sketch for him, he had had to pass it to Buchanan [113], but would prepare another as soon as possible. He gives information as to local prices, congratulates him on the narrow escape of his instruments from an accident on the road, and trusts that he has a good set of followers. He continues ;

I have in the course of my Journey not been inattentive to the points that might be useful in your operations, but through the whole of my Journey I did not observe any flat level that could admit of a mile nearly without some interruption ; there are many commanding open situations with favorable heights near them, well adapted for Stations, and I shall, if you wish it, when leisure permits point out some of these. ...

Let me have the pleasure of hearing from you often ; I know not when we may meet, but it will be with much satisfaction on my side wherever it happens[5].

After measuring his base at Bangalore, Lambton writes ;

It appears from the late acquisition of ceded territories [152], that a wide field will be laid open for me ; and from the meridional course that I propose taking, there is some probability of my extending my operations much to the northwards ; and, if your view should lead you that way, it will much increase the inducement I already have of proceeding northward, as I know it to be so much the wish of Government that our labours would be combined[6] ;

to which Mackenzie replies ;

Permit me...to thank you for your communications on the state of the weather[7], and the goodwill you evince towards keeping up a mutual communication with this side. I am hopeful you will not find me defective in contributing my best efforts to the same ends. ... The Sketch Plan I sent you lately you will consider a general directory for your guidance.

After giving a detailed account of the main routes, with special consideration for Lambton's large instruments, he continues ;

When we approach each other we may easily contrive a meeting, which will be equally desirable on both sides. ... Write me freely if you wish for any further notice that I can give[8].

[1] DDn. 41, 5–1–1800. [2] DDn. 68 (11), 6–2–00. [3] DDn. 66, 23–3–00. [4] ib. 13–3–00. [5] ib. 14–9–00.
[6] DDn. 63 (16), 22–11–00. [7] a brief meteorological journal. [8] DDn. 66, 7–12–00.

To a suggestion that Warren should be transferred to Lambton's survey [115, 119], Mackenzie wrote a discouraging letter to the former, and made this friendly reply to Lambton ;

Your proposition required some consideration, tho' my reply to Mr. Warren himself would indicate my earlier sentiments. In this little interval I have had the most unpleasant accounts from all parts of Mysore of the Survey being suspended, and...I do not feel that I can with any propriety accede, and, as you are so good as to mention "*it will go no further*", I feel more at ease in saying I am concerned and vexed that you should have a proposition to make that I could not heartily support ; but consider, My Dear Sir, the consequence of once introducing a clashing between the two Surveys, which I am convinced never once occurred to you.

Rest assured I shall never omit any opportunity of shewing the sentiments I early expressed on your Plan, and before Mr. Warren asked to be employed with me[1].

Lambton replied that he had made his request

on a proviso that it might be attended with no inconvenience to your operations. But I never entertained an idea that you could wish to get any person off from your Establishment. Be assured I feel perfectly satisfied with what you have done, and in addition to this testimony I am sure you will be gratified when I tell you that I am likely to make much greater progress than I at first expected. ...

I think it is probable we may fall in with each other somewhere in the Sera district[2]. By that time I hope I may have something to offer you that may be of service. Let me know when you think you will reach Sera, and weather [*sic*] you mean to run into the ceded territories[3].

Frequent letters were exchanged during the next few months, with sketches of the country, loans of drawing paper, and enquiries for health ; on 20th June Mackenzie writes ;

I wish much we could have met for some days, as it would have been extremely satisfactory to both, I believe, to have some intercourse after our late long Journeys. If you come to Heroor only, I could go thither with a tent, but all my Establishment &c. must be left here, as I am not in train for proceeding on that part of the Survey without I take a circuit back again at a loss of time, and in fact I am very desirous of getting done altogether with this part of the Country [99]. But why could you not post down here for a day or two ? You need not bring a Tent, as I have room enough for you ; and I can send my bearers to Ayamunglum[4], and a Horse to Heroor to meet you. Come to a resolution soon, as my stay depends on your answer.

Again on August 12th ;

I have received your favors of the 11th Ultimo, enclosing a Table of the Latitudes of your Principal Stations, for which I request you will accept my best thanks. It is very satisfactory to me to find that your Stations taken with such accuracy confirm those I had taken in the common way. ... When those to the Northward of Serah are connected with that point, I shall send you a Copy of the Stations, but this cannot yet be done till I have brought it up to that part. ...

I am sorry to hear of your indisposition continuing so long, but I hope ere this you have got clear of it. I will be glad to hear of your getting the use of your eyes again, but it will be necessary for you to be very cautious for some time. My sight is a good deal affected ; so much that I cannot write at night ; but it proceeds from a different cause, and is not an inflammation ; I find the use of glasses very much affects them[5].

Lambton wrote from Nundidrug on 6th September ;

I find one of your Deputies [Mather] is in the Ballapore District [pl. 11] ; I wish he had applied to me ; he might have had several of my points which I presume would have been of service to him, and unless these Points are taken up by the Surveyors of Districts, one of their great uses is lost ;

to which Mackenzie replied ;

The Stations North of this will be exceedingly useful to you, and save you some time as they would to me had I previous noticed of the clearest and most distinguished points. My Stations near this connect with yours, and I subjoin a note containing Hills and Droogs you may possibly take in your intended Progress, and that will very much facilitate a combination of the whole. ...

I have wrote to Mr. Mather to communicate with you on all occasions ; your ideas of the utility of your Stations being known perfectly coincides with my own. ...

[1] DDn. 66, 12–1–01. [2] Sira, 57 C/13. [3] DDn. 63 (23), 1–2–01. [4] Aymungala, 57 B/12. [5] DDn. 66.

The Stations or Points you determine being made known to the Surveyors will be included by them in the detailed Surveys, and enable me to combine the whole into one General Map afterwards. In like manner, the Stations already taken by the Surveyors being made known to you will enable you more particularly to remark these for the same purpose[1].

He wrote to Mather on the same day ;

Major Lambton wrote me lately, and I only deferred writing to him till I could hear from you. I annex a Paragraph of his letter ; his Stations and connected Points will certainly be useful to you, and I could wish you to keep up and cultivate the best understanding with him, as being very essential to the Service we are all employed on ; he is himself very ready to communicate, and in his private character, independent of his Public, is deserving of every proper attention.

How far you make use of his Stations in this Stage of your Survey I leave you to judge, as I wish to leave the Details of the Provincial Surveys as much as possible to the Surveyors, going on one Uniform Plan [101]; and it was my opinion that Major Lambton's Survey would come very properly to correct and reduce the Principle Stations of each to their proper places in the General Maps to be constructed from the Several Surveys. I merely mention these hints for your information of my Sentiments, which have been always friendly to Major Lambton's and every other Useful Work.

A meeting took place in October, Mackenzie writing from Camp 2 Coss W. of Hindoopour. ... I should if you are near ask the favor of you to meet me at some convenient place, ... but as it must be inconvenient for you with your heavy apparatus, and I am lightly equipped on this Journey, I can without much inconvenience push on to Goodibunda[2] if you are fixed there. If not, let me know where I may find you by going a day's journey Eastward (but not 30 miles from the river, for that distance in these circumstances staggers me a little). I am also desirous of going to Pennaconda for a day ; if you could contrive there to fix with Captain Colebrooke who I fancy is near you, where we might all meet for a day or two[3]. I shall have much pleasure in proceeding toward you...to... any place you please not too far off. If your Great Instrument is fixed at Goodibunda I should like that place in preference, but don't incommode yourself on my account. ...

Best compliments to Captain Colebrooke [122, 236]; I am very desirous of seeing you both[4].

Two days later he writes to Arthur ;

I have just got a note from Lambton, and expect to dine with him this evening ; I can now repay your bark [quinine] with interest :

and again on the 12th ;

I had the satisfaction of finding Lambton with his whole Apparatus up, which is not the case every day. I stayed two nights with them at Bagashully, and had like to have been detained another by the rivers rising suddenly ; however I got off the noon of the 10th. ...

Mr. Mather's triangles, or three of them, sent to Major Lambton, coincide with his to within 160 yards, I think, on one, and half of that is allowed for difference of point of Station ; on the whole I think there is much reason to be satisfied with Mather's work, and Lambton, so far as I could learn, seemed of the same opinion. ...

He is going on with great success on the scheme he originally suggested, of settling certain great points for the correction of Detailed Surveys executed by Plane Triangles with inferior instruments. ... I had an opportunity of comparing the sides of the Triangles on our side with his, on the protracted plan ; from Mudghery to Mudgesy[5] there was a difference of a mile and the others near it in the same proportion. Lambton is of opinion that this must be owing to carrying them so far from a small base, and the exact points in some instances not being possible to be ascertained without signal Staves[6].

To Mather he writes ;

I mentioned to Major Lambton your wish to have some of his Stations. ... He is very ready to communicate any part of his work that may be useful, and you have only to apply to himself in writing or personally, and you will be sure of getting every satisfactory communication ; if you are near him at any time I recommend your calling upon himself, which is much better than any other medicine[7].

Mackenzie wrote to Lambton on 31st October ;

I will be much obliged by your sending me your Triangles between the parallel of Pennaconda and...Serah [pl. 11] as I wish...to compare mine, and trace out the cause of the

[1] DDn. 63, 18–9–01. [2] Goribidnur, 57 G/10. [3] obviously the zenith sector, as the Great Theodolite did not reach India till 1802. [4] ib. 5–10–01. [5] Maddagiri, 57 G/2 ; Midigesi, 57 G/1 ; Hill tops 13 m. apart [99]. [6] ib. 12–10–01. [7] Nothing indeed better than personal liaison. ib. 23–10–01.

difference, whether gradually increasing from my short Base near Hurryhur [95], or from some ill defined points further South, for in carrying on the Boundary I was under the necessity of taking several distant Hills where no distinct object could be seen[1].

and again on 30th November ;

The difference in the line from Mudgery to Mudgesy, ... is now entirely reduced by the Triangles taken since September so as to make the difference very trifling, the utmost being 30 feet. ... A station I took on the Summit of Nidicul helped very much to corroborate and confirm all my Stations round to a great extent [99].

A few days after his move to Madras [101], Mackenzie writes to Warren ;

Major Lambton's Carriage of Instruments is now allowed of, he tells me [334–5] ; I passed a day with him lately at the Mount, where he has begun to measure his Base [237, 256][2].

To Mather he tells of the heavy work involved by the compilation of the topographical surveys, whereas

Major Lambton, having only a small Chart to form of his Triangles, the computations of which could be made in the Progress of the work, was of course enabled to bring his whole work forward some time ago, & has now begun to measure a new Base near Madras. I understood his Establishment is now put on a footing nearly equal to the former, & that in some Memoir he has given in (but which I have not seen) he suggests that taking up his points in tracing the rivers and roads would be more correct than any other work [237, 238].

For my own part, I am confirmed by comparing yours, Mr. Warren's, and our own Triangles with his, & their uniting so well together, that our mode is sufficiently correct for all that is required[3].

Again on 18th May ;

Major Lambton has given me a Plan of his Stations. ... Give me your opinion regarding the utility of following up his Stations & filling up the space between. Do you think you could readily recognize his stations & by following these save time in preference to following those you know & fix yourself ?. Give me your sentiments on this subject soon.

Whatever Mather replied, Mackenzie continued his own primary stations over the whole area of survey in preference to adopting Lambton's triangles and points [112].

In 1802 it was definitely agreed that Warren should join Lambton [115, 117], and Mackenzie writes to Arthur ;

Mr. Warren has been with me here [Madras] near a month, and is now reducing his Colar Survey to the Scale of a Mile to an Inch ; I dare say it will take a month or more. I believe it was settled before you left us that he is to be attached to Major Lambton, who is now to the Southward about Pondicherry ; his large Instrument not yet arrived. I was ordered to recommend someone to act in the situation Mr. Warren has been in, & I proposed Mr. Morison of the Artillery[4].

whilst to Lambton he writes shortly after ;

I cannot disapprove of Mr. Warren's wishing to be employed in situation more agreeable to his own views or wishes[5].

I am glad to find your Grand Instrument is arrived, of which I have heard so much [253]. I should like to see it, but it is not possible for me to be with you on Sunday, as it is the only day I can have to myself for some time ; you will therefore excuse me for this time. I am much hurried at present removing all my things [from Kilpauk] to a house at Vipery[6], which will discompose me for some days ; As soon as I am settled there I shall expect you down for a day, but this we can arrange next week. ...

Have you got out the Philosophical Transactions of last year, or any further account of the Survey in England[7] ?

To Warren he writes in October ;

I hope you keep your health ; I have not been very well with the late hot weather, and many others have been ailing. I have now got another Inmate in this large house[8], which is necessary to fill up the vacancy in so vast a Mansion ; there is however room enough for you when you chuse to take a run down, as there would be were it much smaller.

Give my best compliments to Major Lambton, & tell him if occasion requires his coming down hither, that there will be a Couch for him at my Hotel at Vepery[9].

The original "Plans" for both Mackenzie's and Lambton's surveys had been sent home to the Directors, and passed to Rennell for criticism. He failed altogether

[1] DDn. 63, 31–10–01. [2] DDn. 66, 9–3–02. [3] ib. 19–3–02. [4] ib., addressed to Penang, 28–8–08. [5] ib. Monday, 17th. Sept. 1802. [6] a suburb of Madras. [7] ib. 7–9–02. [8] Probably Morison. [9] ib. 19–10–02.

to realise the nature of the proposals, and his remarks were little to the point [I, 376]. In replying to them Mackenzie thus refers to Lambton's survey ;

I trust that Major Lambton's own explanation of his Plan must by this time shew it to have been entirely distinct from that entrusted to my charge ; both being instituted at different distant periods, and in no respect intended to be connected together further than in that communication and good understanding which works proposed for the improvement of Geography, and sometimes coming in connection, bear to each other [116].

This need not be indeed more strongly illustrated than by recollecting that this Gentleman's operations, for some time, have been directed to the country on this side of the Ghats [236–8], and was no more applicable to Mysore than to any other part of the Peninsula, to which the result of a Series of Great Triangles was meant to extend. ... The Northern Survey [99–100] was carried up to the Pennar[1] nearly about the same time that the Spherical Triangels were from Serah extended into that neighbourhood [235][2].

and to Lambton himself ;

The base at Ballapore...was measured by Mr. Mather & re-measured by him and Mr. Arthur, and the work done with a common chain [205]. Such precautions were used as leaves no little doubt with me of all the accuracy consistent with the nature of the means employed [*sic*].

I can have no objection therefore to your verifying it, as well as the other Bases when you approach them ; at Hurryhur [95] etc., or at any rate the nearest primary stations which you will find in the Chart sent you. I enclose a little sketch of the Base near Ballapore. ... Perhaps it would be curious to ascertain the real difference between a Base measured by a Common Chain, and by the improved one with all the allowances made, & I believe the difference cannot be very essential. Such an experiment by yourself I could have no objection to[3].

In November 1805, Mackenzie wrote from the western borders of Mysore ;

I have been duly favored with both your Letters from Bangalore & Seringapatam. ... I have since September brought up both the detailed & fundamental part of my work to this place (Azimpoor), where I have measured a Base [107]. ... I shall want a few connecting Stations towards the centre of the Country, which I leave till the occasion offers more conveniently on my return. Meantime, by carrying them along the West side, I have the satisfaction to see they agree so nearly with yours, that on common maps the difference will not be perceptible ; & in the Southerly and Northerly & your extreme points...there appears on inspection of the maps very little difference ; Some difference is occasioned by the same points not being taken ; in others I know not precisely yours. ...

I return you my thanks for this plan ; I wish you had added to it on the East as far as... Vellore[4], & on the West so far as you have gone to the Coast ; as in the latter it would point out to me some leading stations ; all along I have been obliged to grope my way in the dark as it were, & consumed much time in reconnoitring & taking Stations that frequently are laid aside for want of previous information.

I continued this way till June, when the state of the atmosphere alone forced me to relinquish the Survey in Bednore, and till within these few days the weather has not been sufficiently clear to tempt me out again. I am now on the wing again to close this part while the weather permits.

Your meridian lines will be of use to me in correcting mine, tho' in the mean time I have taken the variation at our Bases & some principal stations. In the whole of your Triangles I find we have gone over the same ground, & beyond these in several instances. As yours go no further than Hardanelly[5] on the South, I inclose all I can...to the Guzzalatty Pass[6] ; you will find some difficulty in carrying them below the Ghaat, as the ground is so narrow, & I would recommend your going on that hill...where I caused a heap of stones to be erected near our Station ; you will have there a fine view of the Country below, & some good points I think for extending your Stations, even so far as Trichinopoly Rock, which I hope you will include before your return to the Carnatic, as it connects the Southern Geography [I, 170]. ...

On my present Journey I should wish to have any points you can give...to guide my attention towards the Ghaats, & if there be any material point on the Sea Coast that you have taken, it would be still more desirable[7].

In 1808 after Lambton had moved south, Mackenzie wrote to Warren at the Observatory ;

Lambton's difficulties in Tanjore, I suppose, must have arose from the flatness of the

[1] Pennar R. 57 G/9. [2] DDn. 42, 12–7–03 (57–8). [3] DDn. 66, 7–6–04. [4] 57 P/1. [5] 58 A/13 ; pl. 11. [6] 58 E/2. [7] DDn. 43 (133), 15–11–05.

Country, & its being so woody would also impede his Station [241]. I have not heard of him for a long time till you mentioned him, & thought he had gone on to the Madura Country[1].

The following letter written by Mackenzie just before sailing for Java suggest that Lambton had stayed with him in Madras before moving north to the Ceded Districts [245] ;

I am very glad to find by your letter of 14th that you made such progress, and came up so opportunely with your baggage. I trust by this time you are advanced well into the Ceded Districts. ...

I have the pleasure to enclose copy of your list of books and furniture left in this house. ... I have directed Mr. Ward by letter to deliver any part, or the whole, of them to you or your order ; and meantime to look occasionally to their security. The plate particularly to be placed in his own bedroom, as it is in my room at present. You have nothing to do but to write him to deliver whatever box or article you may want to your order.

The name of the senior of the assistants employed now in the Gandicotta district is Michael Dunigan, and I have directed him to attend to every requisition you may make on them for anything within their power, particularly accurate descriptions of the hills and best stations, the roads, the marks at the base, etc. ... I know not whether it would not be useful to them, though perhaps troublesome to you, that one of them should attend the measurement of your base, in order to attend particularly to the observation for the latitude and azimuth. I have lately sent a sextant to Dunigan ; ... I will write him to attend to your commands[2].

The full record of these friendly and chatty letters should safely dispose of the story that there was at any time any unfriendly feeling between these two remarkable men. It is evident that Mackenzie was well satisfied to find that his own triangulation was sufficiently accurate for control[3] ; at the same time he was comforted by the close agreement between his work and the more precise results of Lambton's scrupulous care. The very possibility of such check was an obvious incentive to accuracy. Had Lambton's survey come first, with stations established and clearly marked, Mackenzie would have been only too glad to base his work on the more scientific triangulation[4].

[1] DDn. 43 (246), 15–6–08. [2] DDn. 83, 29–3–11. [3] Note his satisfaction at making his own connection to the Madras Observatory, rather than rely on Lambton [152]. [4] See also pp. 112, 115, 233–4.

CHAPTER IX

MADRAS MILITARY SURVEYS

Route Surveys, 1799–1804 — Military Institution, 1805–15 — Travancore, 1805–11 — Hyderābād & Berār, 1805–11 — Java, 1811–16.

FOR nearly two years after the fall of Seringapatam there was continued fighting along the western borders of Mysore, the principal leaders of the hostile forces being the Marātha adventurer Doondiah who roamed between Bednur and Savanur [94][1], and the Pyche Rāja[2] of Kottayam, who defied the British troops from his mountainous home in north Malabar [I, 132]. So little known were these frontiers that in the treaty of 1699 Wynād [107 n.1, 123] was ceded to the British under one name, and allotted to Mysore under another ! !, a misunderstanding that was put right in 1803 by the transfer of other areas to Mysore in return for recognition of British possession of Wynād[3].

Of the frontiers further north, Wellesley writes to Orr [I, 361] in August 1799 ;

> I am quite at a loss for some knowledge of the principal posts and roads in this, and the Bednore, country. I understand that though your official duty is in another line, you still pay attention to the surveys of the countries through which the detachment marches, and I shall be obliged to you for any communication you can make to me respecting them[4].

Troops were moved up to Chitaldroog in June 1799, and advance columns occupied Bednur. After marching the Grand Army to Honnāli[5] General Harris handed over to Wellesley at the end of August[6]. Doondiah was driven into Sonda [pl. 11] which did not prove the sanctuary he expected, as the Marāthas had declined the cession of that district, and British troops were able to occupy it by the end of September[7].

Doondiah still remained undefeated and a menace to the border, and in May 1800 Wellesley led a considerable force against him and, after a troublesome campaign which revealed his skill as a leader, Doondiah was defeated and killed on 20th November[8].

By March 1800 the Pyche Rāja was giving trouble further south, and there was some discussion about sending an expedition against him at once[9] ; this however had to wait till Doondiah had been settled with, when combined operations were carried out early in 1801 by a Madras column from Mysore and a Bombay force from Malabar.

Much useful survey was carried out throughout these campaigns by James Colebrooke, brother to the Surveyor General, who took over command of the Guides in October 1799. He surveyed the marches of the Grand Army under Harris, Wellesley's marches on the Sonda frontier during 1799[10], and the "Marches of the Army...under Wellesley from entering the Maharatta country to the total defeat of Dhoondiah Waugh at Coonacul"[11]. This latter map covers the country from the Tungabhadra River near Harihar northwards to the Kistna and Gutpurba rivers. His native "guides" also did good work, and Wellesley writes in February 1800 ;

> I have written to Colebrooke to desire him to send some of his native guides, who are more useful than any people I have yet seen in exploring roads for our troops[12].

[1] Bednore, Sanoor [pl. 11]. [2] A junior member of the Kottayam family ; finally crushed in 1805. 58 A/2. [3] Aitchison, IX (183n). [4] *Supply. Desp.* 28–8–99. [5] 48 N/12. [6] Lushington (281). [7] Wilson II (22–6). [8] ib. (14) ; Logan (535) ; Gleig, I (268) gives 10–9–1800. [9] BM Addl MS. 13725 (56). [10] MRIO. Misc. 1–0–08 ; shews positions of Goa and Dhārwār. [11] Kundgol, 48 M/7 ; map, MRIO. 118 (37). [12] Gurwood, I (78).

The elusive and persistent Pyche Rāja took his name from his residence at Palassi, or Pazhassi, about five miles from Kottayam, the seat of other members of the family, whence the name "Cotiote Rāja" [I, 132 n.3]. This densely wooded, sparsely habited, tract lies some 25 miles north-east of Tellicherry and east of Cannanore, with the Wynād lying further to the east along the southern border of Coorg, towards Mysore.

Moncrieff and Williams had been able to reconnoitre the main roads from Tellicherry towards the Wynād [I, 132], but the first opportunity to run a line right through the country came when Colebrooke accompanied Stevenson's column in January 1801[1]. They marched south-west from Seringapatam into the Wynād, and then westward over the Perya Pass[2] into Kottayam, meeting the Bombay troops who had already occupied Palassi[3]. The Rāja himself escaped to fight for many another day, and was not finally accounted for until the end of 1805.

The Wynād was more fully surveyed later in the year by Charles Rand, an officer of the Guides[4].

Meanwhile in 1801 other columns of the Madras Army were engaged in subduing the *poligars* of Shevagunga[5] in the south peninsula, and Bradley, of the Engineers, surveyed various routes through Tanjore, Madura, Trichinopoly, Tinnevelly, and Rāmnād [pl. 16].

Later on, Valentine Blacker held command of the Guides and, besides making various surveys himself, was

indefatigable in instructing the native guides in the principles of geometry and surveying, and he has brought that Corps to a degree of perfection in their duties which was never before equalled[6].

Amongst surveys known to have been made by Blacker are one of the west coast near Anjengo and another of the country between Seringapatam and Coimbatore. He also constructed in 1805–6 a "Map of the Polliams dependant on Chittoor, laid down from actual surveys[7]", which covers a small area north of the Palar River between Chittoor and Arcot[8], and appears to be one of the first surveys based on Lambton's triangulation, for in 1804 Lambton writes to the Quartermaster General, promising to

furnish Captn. Blacker with all the points and distances which have been determined in the Chittoor District, from the Bomraji Pollam to the Mooglie Pass[9], which I trust will enable him to make a complete military survey of the Pollums[10].

Scattered surveys were made at different times in various parts of the Northern Circārs[11], the more extensive of which were made by Sholto Douglas round Vizagapatam during 1810 and 1811 [160].

These scattered efforts did little however to furnish the army with the maps of the Madras provinces that were essential for military operations. The obstruction of the Nawāb of the Carnatic, and the objection of the Directors to the appointment of a Surveyor General, had prevented any continuous system of survey, and we have already noted how soon disappeared such fragmentary surveys as were made by individual officers [I, 119].

In January 1804, at the suggestion of the Surveyor General, Robert Colebrooke, the Governor General re-issued the General Order of 29th September 1788 [I, 196], ordering the regular survey of every military route, and the Commander-in-Chief at Madras, James Stuart, took this opportunity to press the urgent need for the extension of surveys ;

An accurate and extensive knowledge of the Geography and Topography of the Territories dependant upon this Presidency is of high importance. ... It is equally necessary as it relates to the Political limits of our possessions and of those occupied by our feudatories ; to the channels of commercial communication, and to the sources of Revenue, and the internal boundaries of

[1] Date in fdbk. M 114 and other survey records ; but Innes (79) gives 1802. [2] 49 M/13. [3] 6 m. NE. of Kuthuparamba, 49 M/9. Journal, MRIO. M 114. [4] MRO. Map 179. [5] Sivaganga, 58 K/5. [6] Letter from Orr, 3–8–06. *EIMC.* I (323). [7] MRO. Map 272. [8] 57 O/4, P/5. [9] Mogili P. 57 K/16. [10] DDn. 63 (111), 14–9–04. [11] Ichchapūr, June 1801, Edward Fraser ; NW. Boundary, Ellore Circār, Sept. 1808, Capt. G. Hare ; Rājahmundry coast, David Barclay ; DDn. 246 (114, 126).

the Country. But to the successful conduct of Military affairs this knowledge is indispensable. ... Destitute of that knowledge, our Military measures must be crude and imperfect, ... and liable to be counteracted by an Enemy acquainted with the Country. ...

An extraordinary and inexcusable neglect of Geographical pursuits in the Peninsula of India was long prevalent. No regular surveys were instituted with exception of the survey of the Jageer executed by Mr. Barnard [I, 88]. We possessed no other knowledge of the nature of our territories, of our frontiers, or great roads, but what was furnished by the routes of the armies in the Field, and these, being executed under every circumstance of disadvantage, were incorrect and extremely confined. ... The knowledge which we have of the Carnatic and Southern Countries has been derived principally from the voluntary exertions of Individuals [I, 97–100]. ...

These embarrassments were at last apparent to Government after the conquest of Mysore ; and a regular plan was adopted for the survey of that Country. The labours of Majors McKenzie and Lambton have afforded the most decisive and honorable evidence of the advantages of that measure ; ... they have introduced a system of scientific, accurate, and just surveying, and have contributed to enlarge the bounds of General Science.

It appears to the Commander-in-Chief that the existing Surveys are not sufficiently extended, or directed to Military purposes. It is an object of importance that the Surveys...should be completed at as early a period of time as may be practicable. ... Extensive Provinces have been added to this Government of which no regular surveys, and very few Geographical materials, exist. ...

The Commander-in-Chief recommends that Major McKenzie may be directed to consider his survey to embrace the Ceded Districts, with the Provinces of Soonda and Canara ; to recommend such a number of additional Assistants as may be necessary for that service, and to direct the attention of his Assistants to a particular examination of the Towns, villages, roads, passes, defiles, mountains, rivers, forests, ... as may be necessary to render his survey in the greatest practicable degree subservient to Military purposes[1] [103, 107].

Lord William Bentinck, then Governor of Madras, was greatly interested, and at his suggestion the Council again addressed the Directors urging the appointment of Mackenzie as Surveyor General [I, 264–5, 298] ;

The importance of an accurate Topographical knowledge of our possessions in India in a Political, Commercial, and Military view, is obvious ; as well as the advantage of maps calculated for that purpose. It is on this principal that the temporary Establishment of an Office for the Collection, Revision, and reduction under one convenient scale of all existing Geographical and Topographical surveys, has been deemed advisable, and that the Board have adopted the Resolution of recommending to the Honorable Court of Directors, the permanent appointment of a Surveyor General at this Presidency. ...

Major McKenzie and Captain Lambton have undertaken surveys on scientific principles ; they have determined points by means of measurement and calculation, which before had been laid down on very doubtful suppositions. ...

But, however meritorious their personal exertions may have been, the utmost endeavours of themselves and of their few Assistants under the influence of a torrid climate, and amongst many interruptions from the circumstances of the times, will never be equal to the labor of a topographical survey of the extensive territories subject to this Government.

The time of men of science engaged in Geographical pursuits will be chiefly occupied in fixing capital points, and it appears to me that their talents are even misapplied when directed to attainments within reach of inferior capacities. ...

Plans of the nature which I have described cannot be constructed either without great personal exertion, or within a short period. ... But although such sketches and remarks must be highly useful where none before existed, yet it is easy to conceive how imperfect, and even unintelligible such works must often be, where no system of Drawing, and no fixed signs to represent particular objects and features of a country have been established, but where every Officer pursues a different mode of expressing the objects which he sees[2].

The Governor then worked out a scheme for training young infantry cadets of the Madras army in a regular school of survey [314–5], which should become "a Nursery of accurate Surveyors and able Officers[3]".

This was the origin of the Madras Military Institution, and no official corroboration has been found for Markham's statement that it was founded on Mackenzie's

[1] C-in-C.'s minute, 10–8–04, MMC. 14–8–04. [2] Minute of 29–9–04 ; MMC. [3] M to CD. 16–10–04 (240).

advice[1]. He may have inspired the Commander-in-Chief's minute which is, however, dated some weeks after his departure to Mysore, but he could have had little to do with Bentinck's proposals for a training school.

MADRAS MILITARY INSTITUTION

Detailed orders for the formation of the Institution were passed in November 1804, and a class of 12 was chosen from the company of Gentlemen Cadets, to be instructed "in geometry, drawing, and other branches of Military Education", whilst "Ensign Troyer of His Majesty's 12th Regiment of Foot" was appointed "Drawing and Mathematical Instructor"[2] [2].

Survey by planetable was to be taught with strict regard to the essentials of a military map, and the more advanced pupils would "proceed to the trigonometrical calculations". The course was intended to last two years, but the first class was not released for over two and a half.

The first class assembled in April 1805 and, after several months at lectures and theoretical instruction, did three months practical surveying from February to April 1806.

The Madras Record Office still holds a survey of Madras town on the scale of 300 feet to an inch, in eight sheets, and another of Ryaporam, scale 200 yards to an inch, carried out by these young officers between August 1805 and April 1806[3]. They also completed the survey and fair mapping of a "Topographical Survey of Madras and its Environs"[4]. The following October Troyer submitted

two copies of the survey by the Senior class of the Military Institution, the one upon a scale of 4 inches to the mile, destined...to be deposited in the Quarter Master General's office, and the other, upon a scale of 2 inches to the mile, which your Lordship may be pleased to send to the Honourable Court of Directors. The accompanying skeleton of the survey shows the part which each Gentleman has surveyed and drawn ; the united plans from the hands of 12 Gentlemen form the first mentioned copy. ...

This topographical survey was made by means of the accurate bases given by the previous operations of Major Lambton ; the great triangles determined by him were filled up with the details which constitute a topographical, and properly speaking a military, plan.

The instruments used in this survey were two common telescopic theodolites, and the best plain tables such as local circumstances could furnish [229][5].

A second class of 18 joined in April 1806, and both classes took the field at the end of the year, Garling, of the senior class, acting as assistant instructor. The senior class made a survey of Pondicherry and its vicinity[6] ;

The extent of ground to be surveyed by the Senior Class comprehends 1134 square miles. 378 square miles only are destined to the Junior Class, on account of its being their first essay, and of the shorter time allotted to them for it. ...

The survey is to be made on a scale of 4 inches to the mile, a specimen of which has been presented to your Lordship with the first survey of the Senior Class, but from their present proficiency higher expectations may be formed of the goodness of their performances. These are to be accompanied by descriptive memorandums. ... Any fort falling into the Survey... will be Surveyed particularly upon a Scale of 600 feet to the inch.

The bases resulting from Major Lambton's operations will again form the foundation of this Topographical Survey. My best endeavours will be directed towards the determination of such a number of intermediate points, independently of the particular work of each Gentleman, as may ascertain the junction and accuracy of the whole. ...

The allowances granted [331]...are to be drawn only during the time of the Survey, which for the Seniors is to be 7 months, namely from the 1st of January to the end of July, after which they are to be recalled to Madras for the purpose of rectifying their work, and finishing a fair copy of it, ... and at the same time for pursuing some further mathematical and Military Studies.

The Junior Class is to be recalled at the end of 4 months for the continuation of the prescribed course of Studies. ...

[1] Markham (73). [2] MMC. 13–11–04. [3] MRO. Maps 56 & 60 ; Love also mentions a survey of St. Thomé. [4] *IO Cat.* [5] MMC. 21–10–06. [6] MRO. Map 292.

In the division of equal parts to be Surveyed by each Gentleman of the Senior Class, 18 square miles have been taken...as the extent which he may be able to survey within one month, or 108 square miles in 6 months. But by taking into consideration the time necessary for arriving at their destined place, for the reconnoitring of their ground, and any unexpected obstacle, one month has been added to that time, so that 7 months are allotted to each Gentleman for the Survey of the above mentioned extent[1].

Troyer and Chavasse did the triangulation ;

From the middle of January...I was occupied with carrying on a set of intermediate triangles between those of Major Lambton's survey, ... extending it...as far as Trinomallee. Lieutenant Chavasse was forming a trigonometrical connection...in which he was interrupted by indisposition, and obliged to transport himself for medical aid to Cuddalor. We shall have the honor to present you the whole of our trigonometrical operations at the close of our calculations at Madras.

In three months the ten planetablers of the senior class completed from 40 to 108 square miles each, totalling 731[2] ;

The differences in the quantum of the work...proceeds merely from more or less difficulty met with in the respective surveys, and the disappointments with respect to plain-tables not delivered by the instrument maker at the time at which they were promised. ...

The Junior class, ... under the particular Superintendence of Lieutenant Garling, have meanwhile nearly finished the survey of the general area allotted to them, and are now proceeding to connect, by sections voluntarily undertaken, their surveys with that made last year by the senior class in the environs of Madras[3].

With his reports of December 1807 Troyer recommended the posting of the senior class to various field surveys [317], and a new programme for the junior classes ;

The former possessions of France and Holland[4] on the coast were surveyed by the Institution during the last season. This survey...includes several tracts beyond the limits of the Foreign possessions, and while the Gentlemen of the first class were engaged in its prosecution, the Junior class surveyed the country extending along the coast from the Presidency to the boundary of the French Districts, thereby connecting the survey of the environs of Madras, already executed by the Institution, with that of the foreign possessions.

During the ensuing survey it is proposed that the Districts extending from Tripassore towards Chingleput[5] shall be allotted to the Junior Class, and that those stretching Westward from the Meridian of Tripassore towards the Ghauts, which border on...Tripety and Chittoor[6], shall be surveyed by the first class. The facility of surveying the former districts in consequence of the flatness of the Country is suitable to the attainments of the Junior Class, and the mountainous nature of the latter has suggested the expediency of allotting them to the first class. ...

But considerations of much higher importance urge the propriety of surveying without delay the tract to the northward of Tripassore. ... The contiguity of that tract...to Madras, its strength and military advantages, ... together with the importance of its position, which commands the most direct communications with the Ceded Districts and the Northern Division, render it extremely desirable that it should be accurately examined and known, but it is an extraordinary circumstance that we are at present almost entirely ignorant of the topography of that country ; no maps or surveys of it are to be found under this Government, and we possess less knowledge of it than we do of the Nizam's and Peshwa's. ...

Major Rennell, in constructing his map of the Peninsula, particularly adverted to the deficiency of geographical materials of the countries between Madras and the Kistna [I, 99], and few additions have been made to them since the date of his Memoir.

If the Government should approve of the plan, ... the Institution will produce in the course of two years a complete and most accurate Topographical survey of the whole of the Western Pullams. ... If the Western Polygars should be suppose to entertain sentiments adverse to their allegiance, ... nothing would contribute more to prevent the effects of that disposition than an accurate knowledge of the roads and fastnesses of their Pollams[7].

To the Quartermaster General, Troyer proposed that

the Junior Class are to continue the former survey on the side nearest to Madras, upon an extent of seven hundred and twenty nine square miles, on a scale of six inches to a mile, as this will be their first essay in Topographical surveying. ...

[1] Report from Troyer, 31–10–06 ; MMC. 29–11–06. [2] *Cuddalore to Coleroon R. & West to Rajanagarh* ; reduced to ¼-inch scale ; MRIO. 133 (16). [3] MMC. 10–4–07. [4] Pondicherry, 58 M/13 ; Kārikāl, 58 N/13 ; Negapatam, 58 N/13 ; Tranquebar, 58 M/16. *Map of Tranquebar Town*, 400 ft. to an inch ; April 1808 ; James Swinton. [5] 57 P/14. [6] Tirupati, 57/6 ; Chittoor, 57 O/4. [7] MMC. 4–12–07.

The senior class are...to survey the extent of ground noted on the plan, taking in a part of Bomrauze's Pollams as a country less known, and comprizing in the whole one thousand seven hundred and twenty-eight square miles.

Except for the western *pollams* [370], of which the survey could not be sanctioned, this programme was completed by the end of May 1808 ;

Each officer of the Senior Class has finished the four sections comprehending 108 square miles allotted to him. The junior Class have exceeded the portion allotted to them by about 600 square miles, which is chiefly owing to the zealous exertions of Lieutenant Garling, my Assistant. ...

I reserve to myself the honor of laying before you the plan of our trigonometrical operations as well as the Book of the calculated triangles, with the fair copies of the particular surveys of each officer[1],

The next four months were spent in making fair copies on the four-inch scale, and in reducing to the 2-inch scale, each officer working on his own area[2] ; the senior class also received " a course of instruction in some branches of the higher mathematics ".

The programme for the early months of 1809 covered an area immediately north of Madras, but the season was cut short by " the White Mutiny ", in which a large proportion of the British officers on the Madras establishment mutinied and led their regiments against Government on the pretext of various grievances, the most prominent of which was the abolition of the Tent Allowance[3]. Even the cadets were led astray, and eighteen of the junior class at the Institution were ordered to their regiments in February[4]. By August more than 1300 officers had been placed under custody, whilst fewer than 150 had signed the *Test* of loyalty that was demanded [314]. Peace was at length restored, and the senior class sent out on survey ;

The operations of Major Lambton's survey...have not been carried much to the Northward of Madras, and the present engagement of Major Lambton in the Southern parts of the Peninsula render it improbable that he will return to this Quarter for a considerable period of time. But as the tract of country to the Northward of the Presidency is of great Military importance, and is very little known, it ought to be surveyed with the least practicable delay by the Institution, and it will be requisite for that purpose that it's general Geography should be previously determined by Trigonometrical operations. ...

It is proposed that a survey shall comprehend the Pulicat Lake, hitherto very imperfectly known, the countries to the Northward and Westward of the Lake, and a part of the mountainous tract occupied by the Western Polygars. The considerations which I have stated induce me to recommend that a Trigonometrical survey of these countries may be conducted by Lieutenant Garling, assisted by Lieutenant MacGlashan of the Institution, and that a subordinate topographical survey of the same countries may be prosecuted at the same time by Lieutenants Young, Conner, Fyfe, Cameron, Hancock, Dunn, and Lethbridge of the Institution[5].

This survey included Kālahasti and Tirupati[6], and was carried on until August 1810, when Garling was ordered to take the party across the peninsula to survey the Portuguese territory of Goa [156].

Henry Bevan[7] [320] gives the following account of life and work at the Institution. He came out to Madras in January 1809 and joined the cadet company, then at Cuddalore ;

Being favourably reported of by the Officer in charge, in May following I was recommended as a candidate for the military institution at Madras. ... Towards the middle of 1809 the military institution was suspended by Government. ...

Soon after I had joined ... , it was resolved to employ the officers...in a practical survey, for which they were eminently qualified. It was my good fortune to be engaged in this service ; and bidding adieu to all controversies, civil and military, we devoted ourselves to providing camp-equipage, and all other necessaries, preparatory to our quitting Madras.

When all our arrangements were completed, we crowded to the southward on a topographical

[1] From Troyer, 28–5–08 ; MMC. 1–7–08. [2] *Triangular Survey of S. portion of Vellore, North Arcot ;* Hills neatly hachured ; unfinished reduction ; MRO. Map 271. [3] Cardew ; Wilson (233, 236). [4] MMC. 18–2–09. [5] From QMG. 22–12–09, MMC. 2–1–10. [6] 57 O/10 & 6. [7] b. co. Limerick, 9–9–1790 ; m. 30–10–32, Mary Ann Curtis, of Guernsey, who d. of cholera, Salem, 23–7–37 ; ret. 25–10–37 ; d. 1846.

survey near Gingee[1]. ... Each section contained 27 sq. miles, on a scale of four inches to the mile, and two at least of these sections were expected to be completed by every officer previous to his return [215]. A military memoir or record, embracing the resources, population, roads & pathways, facilities of defence, obstacles, statistics, with such military and other useful reminiscences as could be obtained, was to accompany each official return.

Captains T. and A.[2] superintended the whole of the officers during the survey. Having completed my share of the duty by the end of February 1810, I amused myself the remainder of the time allowed in hunting and shooting. ...

We completed fair copies of the surveys, and continued our studies in the higher branches of mathematics, during the remainder of 1810, so as to be able to use the theodolite and calculate angles by logarithms. ...

We proceeded on our second survey, to fill up the Topographical details in those triangles that had not been completed in the preceeding year, in the vicinity of Gingee, Arnee, etc. Having finished mine before the time specified, I was requested by Capt. S. to undertake that part of Capt. M's. survey which he was compelled to leave unaccomplished owing to a severe attack of fever, peculiar to Gingee, but which through the mercy of Providence I escaped, and finished the survey, for which I received the thanks of Capt. S. and Col. B.[3] the Q.M.G. ...

Bevan was employed on other surveys after leaving the Institution, and records that

considerable hardship, fatigue, and exposure, are consequent on the detail and minuteness of topographical surveying, as I have frequently had my feet blistered while on that duty, being... obliged to clamber up to the tops of rocks in order to gain a prospect of the country where flat and covered with jungle ; especially when it became necessary to obtain an elevated position to command a bird's-eye view of its general features, ...

An order just arrived from the Court of Directors had the effect of removing me from the "Survey Branch", as "no officer for the future was to be allowed on the staff, or hold any employment, until he had done two years regimental duty with his corps" [314][4].

On the appointment of a Surveyor General in 1810, the Quartermaster General was at the same time given a definite establishment of surveyors for work on surveys that were essentially of a military character. The Military Institution remained under his orders, but the programme was to be settled in consultation with the Surveyor General[5];

Some rules should be established for the conduct of surveys which are undertaken by the students of the Institution ; unless these shall be arranged in communication with the Surveyor General, it may occur, as it has before I believe been the case, that the same tracts may be surveyed twice over. ...

An idea being prevalent that it is intended to prosecute a General topographical survey over the whole of the Country, I think it necessary to take this opportunity of stating that there is no such intention.

The students of the Institution have, it is true, nearly completed a topographical survey of the soubah of Arcot ; ... and when surveying parties are sent out for the purpose of instruction, it may be adviseable that they should be employed in prosecuting that work so far only as may be necessary for teaching them, but at the same time the employment of these parties, ... in communication with the Surveyor General, will be the means of saving expence at a future period[6].

Classes of students continued to be posted to the Institution up till 1814; sometimes a large class of 20 was appointed every second year, and at other times a class of 10 was appointed two successive years. Troyer continued as Instructor, doing most of the minor triangulation himself. Garling's place as assistant instructor was taken by Walpole, and an extra assistant was obtained from time to time from the ranks of past pupils, to assist during the field season.

The area covered by the Institution surveys before they were closed down in 1816 is shown on plate 24. Being on the large scale of 4 miles to an inch, they showed a mass of valuable detail, but it was unfortunate for their value to civil officers that they showed no administrative boundaries; possibly it was wise not to

[1] 57 P/7. [2] Troyer and his assistant, presumably Garling. [3] Capt. S. probably intended for T. (Troyer); B— Blacker. [4] Bevan (33, 38, 44). [5] Draft regulations by Mackenzie, 12–12–10. MRIO. M 59. [6] Governor's minute, MMC. 29–1–11.

leave such a controversial and important matter to very young officers. Reviewing the work several years later, Montgomerie writes ;

It is in this faithful delineation of the features of the country that their chief merit consists, for in many other respects these surveys are very defective. The absence of all Revenue or Political Boundaries, and the inaccuracy of the names, renders these Surveys of far less value than they would otherwise have been, and from the carelessness of some of the Officers employed the detail in some sections is inaccurately laid down. These defects however admit of future correction, and it must at the same time be admitted that by far the greater part of these Surveys are, with the exception of the Goa and Soonda Surveys [156–9], the best of Indian Topography and Geography[1].

Each pupil reduced his own work to the two-inch scale at the end of the season, but no immediate attempt was made to compile a general map. In May 1810 James Kinsey, of the second class, was appointed

to be a temporary Assistant in the Institution for the purpose of arranging and Registering the different trigonometrical and topographical materials &c. which have been collected there from various surveys [275][2] ;

but on the appointment of the Surveyor General a few months later he was absorbed into the Q.M.G.'s department for other duties.

Two years later Troyer made definite proposals for compiling the surveys into useful maps ;

A Copy of the existing Plans of Surveys upon a more commodious reduced Scale has been a great Desideratum, since the mass of the Topographical materials produced...has now increased to the amount of about 10,000 Square Miles, upon a Scale of 4 Inches to the Mile, lodged in three rectangular Boxes.

The scale upon which the Plans have been executed, although by no means too great for a Survey particularly intended for Instruction, will prove...incommodious ; ... the few details and the great uniform features of some tracts of the Country may be represented with sufficient distinctness in a much smaller Compass. ...

I beg leave to represent the expediency of an immediate beginning of the work, for the success of which...the acquired skill in drawing of Cornet Montgomery and Ensign Mountford, of the present Class, ... would be of the greatest Service[3].

In June 1812, therefore, Montgomery and Mountford, both of whom were beautiful draughtsmen, started to reduce the surveys to the ½-inch and one-inch scales[4], and a magnificent job they made of it. They each completed a separate map, and Troyer submitted both to the Surveyor General in February 1815 ;

The first copy, drawn by Lieutenant Mountford...upon a scale of half an inch to the mile, is...destined to be sent to the Hon'ble Court of Directors, and consists of 6 plans comprizing 14,094 square miles, which have been surveyed from 1805 to 1813 inclusively. One of these plans contains the Javady Hills[5] which form one connected mass of mountains separate from the Ghauts, upon the limits of the Carnatic and Mysore, to which the profiles of the whole elevated tract of Country are added. ...

The other copy...executed by Cornet Montgomerie[6]...upon a scale of 1 inch to the mile, which scale admitted of a more distinct representation of the country, is destined to remain in the Surveyor General's Office, and consists of 14 plans comprising 16,018 square miles, surveyed from 1805 to 1814 inclusively [pl. 12].

Both the copies are accompanied with a trigonometrical skeleton[7], ... in which the triangles furnished by Major Lambton are marked with red lines, and the intermediate triangles...by the Military Institution...with black lines. ...

The agreement in the junction of the operations of so many hands was by itself no indifferent trial of the accuracy of each particular work[8].

In forwarding these maps to Government, Morison commented that,

while the public have derived great advantage from the Establishment...by having disseminated thro' the army a degree of useful science which must add materially to the professional efficiency of the Officers of the Army, ... a valuable survey of an extensive tract of country may be considered to have been carried on at little or no expense whatever[9].

[1] DDn. 246 (89 1827). [2] MMC. 22–5–10. [3] DDn. 127 (295), 10–6–12. [4] MGO. 17–7–12. [5] Unfinished map of Javādi Hill (57 L/SE), 1-inch scale, MRIO. 135 (1). [6] MRIO. 145 (5–18) MRO. map 271. [7] Copy by Montgomerie, scale 4 m. to an inch, MRIO. 144 (3). [8] From Troyer, 2–2–15 MPC. 427/1815 (705–17). [9] From Morison, ib. ; 20–2–15.

Mountford prepared another general map, scale 8 miles to an inch[1], which Mackenzie specially commended for "the beauty and neatness of the work; ... the Plans in question comprehending the greater part of the lower country between the Rivers Kistnah and Coleroon, now completed in detail on one uniform method[2]".

The success of the Institution in setting a high standard of survey and draughtsmanship was even more important in providing a generation of military surveyors, who put into practice and improved upon the systems evolved by Troyer and Mackenzie, and gave Madras a series of maps that was unequalled anywhere in India till the Himālayan and Punjab surveys of a later generation. The principal factors of the Madras system were;

First; The trigonometrical survey of Lambton, with its great triangles broken down by secondary triangulation as first introduced by Troyer, and developed by Garling.

Second; The survey of detail by planetable as taught at the Institution, which superseded or supplemented Mackenzie's system of theodolite traverse according to the nature of the ground.

Third; The regular survey of administrative districts with internal and external boundaries, and the systematic collection of statistical information.

Fourth; A steady supply of well trained assistant surveyors.

Fifth; A body of educated officers trained in the best principles of survey, fit to act as surveyors in charge of extensive surveys.

Finally; A sound organization in the form of a Survey Party, or unit complete in every essential feature for carrying on a survey over a number of years irrespective of individual casualties; supported by an efficient headquarter office at the Presidency. The details of this organization were worked out with great thoroughness by Mackenzie.

The following tribute was paid to the Institution by Andrew Waugh in 1846;

In former years there existed at Madras an institution founded by My Lord Wm. Bentinck, and placed under Captain Troyer, by whose able tuition several Officers were trained up to be excellent Surveyors and Draughtsmen, and as Assistant Surveyors were subsequently appointed to each survey, the knowledge and skill acquired by the seniors was duly communicated by a system of field instruction to those recently appointed.

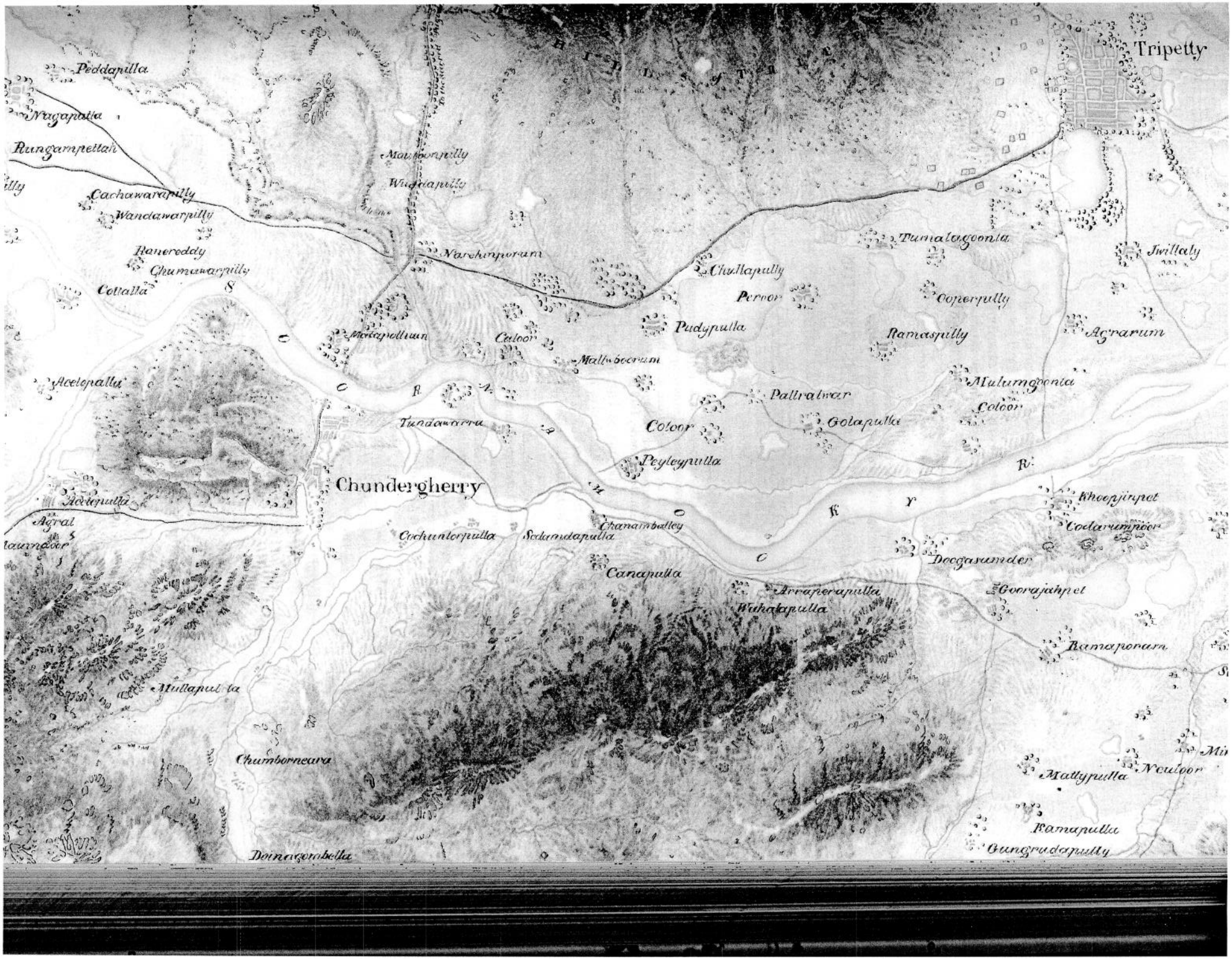
Promotion also at that time was made to depend...on proofs of proficiency, founded on work actually executed in the field. ... This system produced vigor and efficiency, and a great deal of good work was done. Under this system were educated such men as Captains Garling, Conner, and Du Vernet[3], and by its means were produced the excellent Military Surveys of that Presidency on a scale of one mile to an inch, exhibiting all details required for Military or Civil purposes in the existing state of the country[4].

The happy choice of Anthony Troyer as instructor is of particular interest. He was brought out to India as an A.D.C. by Lord William Bentinck in 1803, having been an officer of the Austrian army, and educated at the Austrian military academy. Starting the surveys of the Institution shortly after Lambton had completed his first series of triangles along the Madras coast [236–8], he was able to introduce for the first time in India the soundest principles of topographical survey, breaking down the main triangles of the trigonometrical survey by his own minor triangles, and filling in the detail by planetable on sections laid out in a continuous rectangular grid. Holding the post of instructor for eleven years, he trained a large number of officers in this system which, in its main principles, has persisted to this very day. He was fortunate in finding a talented and able assistant in James Garling, who held independent charge of one survey after another from 1810 till his death in 1820.

TRAVANCORE, 1805–11

Though the Company had always been on friendly terms with the rulers of

[1] A reduction to scale 4 m. to an inch was also made by Ward, DDn. 246 (37, 90). [2] From SG. 17–6–15, MMC. 15–6–16. [3] Du Vernet was not at the MMI., reaching India in 1823. [4] DDn. 462 (58), 24–9–46; see also DDn. 452 (70–3), 13–1–44.


Tripetty
Peddapilla
Nagapatla
Rungampettah
Cachawarapilly
Wandawarpilly
Haneroddy
Chumawarpilly
Cottalla
Narchinporum
Tumalagoonta
Jwillaly
Chullapilly
Perroor
Cooperpilly
Pudypulla
Ramaspilly
Agrarum
Malapollium
Coloor
Mallaboorum
Mulumgoonta
Pallralwar
Coloor
Golapulla
Tundawarra
Coloor
Peyleypulla
Chundergherry
Khoopjirpet
Codarumpoor
Cochunlerpulla
Sodandapulla
Doogasamder
Canapulla
Goorajahpet
Wuhalapulla
Ramaporam
Mullapulla
Chumborneara
Mallypulla
Ramapulla
Gungradapully
Doinagombella

MADRAS MILITARY INSTITUTION

From the one-inch map reduced from four-inch survey carried out by officers of the Madras Military Institution in 1810. Drawn by Duncan Montgomerie, 1813 [129].

D. Montgomerie

Travancore, and had possessed a Factory[1] on its coast since 1684 [I, 96 n.1], little was known of its geography. It may be remembered that when Pringle crossed Travancore in 1779 he was closely watched, and prevented from making any observations or surveys [I, 96].

In 1798 James Dardell, engineer to the subsidiary force at Quilon, was deputed to survey the harbour and roads to discover a safe anchorage for the Company's ships[2]. By 1804 he had completed "a Plan of the backwater from Cranganore to Quilon, drawn from materials collected at different periods[3]" [pl. 16].

On Dardell's death in January 1805, the Resident wrote

that since the death of Captain Dardell, ... the Dewan has requested me to express on his part...an anxious desire for the presence in this country of an Engineer and Surveyor, for the purpose of completing, in the first instance, the service upon which Captain Dardel had been employed, and for commencing...a regular survey of the Territories of Travancore[4].

John Blair, of the Madras Engineers, was appointed to take up this survey under instructions from the Resident at Quilon[5];

The Northern portion of Travancore being intermixed with land the property of various petty Chieftains, with some spots subject to the Honorable Company, these divisions of property, and the line of limit bounding each, should if possible be accurately ascertained and laid down[6].

He does not appear to have made much progress, for he writes at the end of June;

I lost no time...in commencing upon a survey of the Travancore country but I was much impeded at first, and latterly entirely prevented from proceeding, by the badness of the weather, which has been constantly hazy when it did not rain, so that little could be done in the way of surveying. I therefore with the less reluctance availed myself of your permission to proceed to this place [Quilon] for medical advice[7].

In January 1807 he was appointed to the Nizām's Dominions and, as Ravenshaw who was to have relieved him asked to be excused, Thomas Arthur, who had been some years under Mackenzie on the Mysore Survey [95–107], was appointed to Tranvancore, and joined his duties before the end of the year, the Q.M.G. advising Government

that he had received detailed instructions for his guidance. ...

The state of the Travancore survey seems to demand the attention of Government. The high importance of that country, ... and the immense resources which it possesses, makes it extremely desirable that a comprehensive and minute survey...should be obtained without delay, and the present moment of General tranquility in the Peninsula affords a most favorable opportunity for the accomplishment of that object. The surface of the Travancore country, covered with mountains, lakes, and plantations, oppose greater obstacles to the prosecution of a survey than exist in any other part of the peninsula, and the climate in many parts of Travancore is extremely unhealthy[8] [3].

Four officers from the first class of the Military Institution joined Arthur in December 1807[9], apparently Biss, Dalgairns, William Harris, and another. Finding progress impeded by the lack of roads, Arthur applied for

a small party of Pioneers; ... indeed it would appear scarcely practicable, without excessive tediousness, to carry on a survey if a country like Travancore, so studded with wooded heights and so generally impervious, unless some such assistance be furnished[10].

A party of 25 Pioneers under a sergeant was supplied.

In November 1808, Garling and five other officers of the first two classes of the Institution, including all those in Travancore[11], were sent to Bombay to accompany Malcolm's mission to Persia[12]. The mission was held up, and the officers were employed for several months under Malcolm, drawing a map which stretched from the Indus to the Nile. On the break up of the mission in April 1809, Garling returned to Madras, and the remainder rejoined the Travancore survey [174].

[1] Anjengo, a British possession till 1947 [pl. 16]. [2] Bo PC. 13 & 16–10–1798. [3] MMC. 10–12–11 & DDn. 246 (49). [4] MMC. 8–3–05. [5] *Survey of Part of the Kingdom of Travancore, including Arambooly Lines*; Blair; DDn. 127 (32), 26–10–06. [6] MMC. 11–6–05. [7] ib. 16–7–05. [8] ib. 6–11–07. [9] DDn. 84 (93), 27–8–10. [10] from Resident, 23–6–08; MMC. 19–7–08. [11] Chavasse, Dalgairns, Wm. Harris, Alexander Stewart, Swanston. [12] MGO. 17–11–08 & BSC. 20–2–09 (50).

In December 1808 disturbances broke out in Travancore, which were only suppressed by a strong British column which marched from Palamcottah and forced the Aramboli Gate[1], the principal pass over the Ghāts. In this action Lambton distinguished himself as engineer[2] [242]. His assistants, Swinton and Riddell, made a *Sketch of the Arambooly Lines*, 200 ft. to an inch[3]. Arthur also won the thanks of Government for distinguished conduct in the defence of Quilon on January 15th[4].

At the close of the campaign the survey was pushed on ;

The Commander in Chief...entirely concurs in the...opinion stated by the Resident...and by Major Blacker[5], relative to the expediency of accelerating the completion of the survey of Travancore ; ... an application may be made...to send to Travancore such of the Gentlemen of the Military Institution as may not be required in the Persian Gulph [131], and...he may... desire Major Lambton to transfer for the present to the survey of Travancore as many of his Assistants as can be spared[6].

Swinton and Riddell were placed under Arthur's orders till the monsoon set in [243], and other officers, besides those from Bombay, joined the survey in May 1809. Arthur appears to have had under him, at one time or another during the next two years, Alves, Chavasse, Dalgairns, Harris, Murray, Stewart, and Swanston[7]. Early in 1810 he submitted his maps of southern Travancore to the Quartermaster General, including,

Topographical Plan—Net of Triangles, and...calculations for correcting the Base—Observations for Latitude and Longitude, and for calculating the Meridian—with a covering letter ;

Thus, Sir, We have endeavour to execute your orders, and we should derive infinite satisfaction if, at a future day, when the operations of Major Lambton shall have been carried across our labours, if you (whose indulgence will not fail duly to bear in mind the paucity & imperfection of our instruments) should then consider this our maiden attempt at a complete whole not altogether unsuccessful[8].

On the appointment of the Surveyor General in October 1810, all the military assistants were withdrawn to their units [322] and, as his proposal to employ sub-assistants from the surveying school was turned down[9], Arthur finished off his general map, leaving the survey uncompleted. The last surveyor left was Alexander Stewart who

reports his being employed generally on a different duty, in lining out roads for the Pioneers, and lately...that the Party of Pioneers usually attached to him had been withdrawn, and that the survey cannot be carried on without the aid of Pioneers, or of a number of Country people[10].

Arthur remained in Travancore as engineer till his death in 1817, making occasional surveys for roads[11], and of the boundaries of Cochin[12]. The haphazard progress, and the eventual abandonment, of this survey is typical of work carried out before the appointment of a Surveyor General;

From 1806 till 1811, tho' different Officers were successively appointed, very little progress had been made, ... in a great measure owing to the repeated removals and changes before any one part was completed, whence its results, coming under the inspection of this office in January 1811, scarcely included 595 miles of detailed survey out of 6761 miles estimated for that country ; in these circumstances that survey was discontinued at the time, and suspended till an opportunity could offer of taking it up with greater prospect of effect by employing a sufficient party for that sole purpose[13].

HYDERĀBĀD & BERĀR, 1805–11

On his appointment to superintend the survey of Mysore, Mackenzie was allowed to retain his post[14] as Engineer and Surveyor to the Subsidiary Force at Hyderābād [I, 112, 350 ; II, 3], although it was obviously impossible that he would be able to continue the duties of that post [312, 330].

[1] 58 H/12. [2] *As AR.* XI. 1809 (47). [3] DDn. 246 (51). [4] MGO. 4–2–09. [5] now DQMG. [6] MMC. 21–3–09. [7] *East Quilon with coast.* C. G. Alves. MRO. Map 396 ; MRIO. M 339. List of Plans, DDn. 127 (32). *Map of Trichoor, with Mountains to the East.* 1809, by Harris, Chavasse, & Swanston ; MRO. Map 401. [8] sd., Bawady Fort, 18–1–10 ; Lieut. John Harris, M 106. MRIO. [9] MRC. 30–10–10. [10] MMC. 26–2–11. [11] *Routes in Travancore,* MRIO. M 11 ; MRO. Map 386. [12] MJC. 1813–5 ; MRIO. M 107 ; Map, *IO Cat.* (414). [13] Report by Mackenzie ; M Rev Bd. 26–6–17. [14] and the allowances attached thereto.

Occasional route surveys were made through the Nizām's Dominions during the next five years, and during the campaign against the Marāthas of 1803 James Colebrooke surveyed the marches of the Subsidiary Force through Berār, his map extending from Ellichpur towards the south and west[1] [165]. Berār was at this time but little known and Mackenzie had in 1795 pointed out that he had been able to add nothing to its geography [I, 118].

In 1805 the Commander-in-Chief pointed out

that the Engineer to the Subsidiary Force at Hyderabad has been absent from the duty of that appointment for three years and, from the employment of that Officer, he sees no prospect of his return to that station. ...

The Commander in Chief, upon his first arrival, felt surprized that so important a station as Hyderabad...should remain without the presence of an Engineer of reputation, but—unwilling to disturb any arrangment that appeared to favor so distinguished a character as Major Mackenzie—he did not immediately follow the strong impulse of his mind and recommend a successor; but he should think himself at present culpable if he did not...state his intention—in case Major Mackenzie cannot resume his duty—of naming another Officer to replace him. ...

In the Event of the continued absence of Major Mackenzie, the Commander in Chief proposes to recommend Captain De Havilland, an officer of ability and high Character[2].

In approving De Havilland's appointment Government ordered that he should be given

such instructions...as may be best calculated for the early completion of the survey, in which considerable progress had been made by Major Mackenzie previously to his removal to his present station in Mysore.

The Subsidiary Force was at this time on field service against *pindāris* in Berār, where Robert Gordon, of the Bombay Engineers, kept the route of the

march from Ahmednuggur with the [Poona] Subsidiary Force under the command of Col. Wallace—from Ahmednuggur 24th May 1805—Aurangabad 2nd June—Adjuntee 10th June. On June 14th met at Jamnair with the Nizam's Subsidiary Force; marched to Futtaypour and cantoned for the rains[3].

It was of this route, or another of about the same time, that Gordon commented; "The above route from camp near Fatehpur to Jaulna is far from being correct, it having been my first [attempt] at surveying, and that too with a Pocket Compass[4]", and it may also have been Gordon who surveyed the return march of a detachment of the Poona force "having under my charge 20 Pontoons", leaving Fatehpur 20th September, and reaching Ahmadnagar 7th, and Poona 18th, of November[5].

On his march northwards De Havilland surveyed the route "from Hyderabad to Ajuntah, via Daroor and Aurangabad[6]", and after joining the Subsidiary Force at Fatehpur, beyond the borders of Berār, he asked that he might be

furnished with a correct Draught of Surveys which have heretofore been made of these parts of the Peninsula. ... What of this nature has come under my observation since my arrival in Camp appears to me imperfect, nor can I rightly distinguish what parts may be depended on as a foundation, or Basis, on which to construct a general and correct map.

My appointment with Surveyor's allowances makes this one of my principal duties and, being provided with instruments for taking celestial observations, ... the detached routes, surveys, and sketches, will be connected with ease and accuracy. But, if I am ignorant of what has already been done in this line, it is evident I may neglect what requires my earliest attention, while I am throwing away time and labour on points already well known[7].

Close, now Resident at Poona, writes that,

At the period when the Pindarries entered Berar, ... I suggested to Colonel Wallace, who was then in advance, that it might be expedient to employ the Engineer of the Hyderabad Force in examining the different passes in the Injaudry Hills which lead from the Tapti into the Northern parts of Berar, in making a Sketch of these Hills and the Country connected with them, and...a minute description of the routes generally frequented by the Pindarries and other Freebooters[8].

De Havilland accordingly completed a

[1] Map, MRIO. 67 (16); By treaty of 1804 Berār had been ceded by the Nāgpur Rāja to the Nizām; by treaty of 1853 the Berār districts, Amraoti, Buldāna, Akola, and Yeotmal, were placed under British administration, and attached to Central Provinces. [2] MMC. 15–4–05. [3] Ajanta, 46 P/10; Jamner, 46 P/13; Mack MSS. LX (38); DDn. 278 (52–3). [4] Maps, MRIO. 118 (8–10). [5] Mack MSS. LX (34). [6] Dhārūr, 56 B/1; DDn. 246 (145). [7] From De Havilland, 6–7–05. MMC. 339/1805. [8] B Pol C. 26–6–06 (18).

Map of the Northern Frontier of their Highness the Nizam's and the Peishwah's Dominions, from Aumnier to Soanghur[1], surveyed by order of Colonel Wallace, Commanding the Force in advance, in January and February 1806[2].

Of this survey Wallace writes

I cannot sufficiently applaud the zeal and industry and, as far as I can judge, of ability, which has been displayed by Captain de Havilland in the collection of Geographical information respecting this country during the short period he has been in it. His exertions have been indefatigable, and he has never lost an opportunity of adding to his materials.

He notices in his last letter to me the great want there exists of a general and careful compilation of all the surveys which have been made of the Deccan. There is no doubt that such a work would be of the utmost utility[3].

De Havilland's map was passed to the Surveyor General, and Colebrooke writes that the map

appears to be not only correct, but to have been finished in a very masterly style. I would therefore recommend...that Captain De Havilland should be employed in compiling a General map of the Duckhin. ... This map should include the whole of the Nizam's and Peshwa's Dominions, and as much of Goondwanah [25 n.5] and the Eastern parts of Berar as he finds it practicable to survey. ...

The country included between Nagpoor and Hyderabad, and to the eastward of a line drawn between those two capitals through Nirmul[4], is hitherto but very imperfectly known ; I would therefore recommend the whole of this track, as far east as the Beingunga[5] and Godavery, to his immediate attention, as a survey of it would prove highly beneficial to geography.

Should Captain De Havilland be able to penetrate into the country on each side of the Godavery, which is partly tributary to the Nizam, or to procure from the natives (one or two of whom he could instruct and provide with pocket compasses) any routes from which a map of the countries of Bustar[6], Jeypoor[7], and Rampah, could be constructed, such a document would prove of infinite value. ...

I have indeed already recommended to his attention the country lying in a North Easterly direction from Hyderabad as far as the Godavery and Wurda Rivers[8], and this Tract being all included in the Nizam's Dominions, he would, I imagine, not meet with any obstacles to prevent his commencing the survey of it immediately[9].

De Havilland could not, however, be spared for this survey, and he was recalled for engineering duties. His post with the Subsidiary Force was taken by John Blair [131], who surveyed a route "from Hyderabad to the top of the Sindwah Pass" during 1808[10].

During the cold weather of 1808–9 the Poona Subsidiary Force was again on service in Khāndesh under Wallace, where its routes were surveyed by George Brown of the Bombay Pioneers, who records that his route was "absolutely measured by a perambulator and surveyed", and that "Captain De Havilland's Survey was found perfectly correct[11]".

In 1807 Blair was given the assistance of two officers from the Military Institution, Burnett and O'Donnoghue, and these officers, together with Jourdan and Hanson who had been sent up to the Poona Subsidiary Force [166], surveyed the marches of the army operating against the *pindāri* leader Mīr Khān. Early in 1810 they reached Sironj[12], and connected with Morrieson's survey from Bundelkhand [50]. Burnett and O'Donnoghue then worked in the neighbourhood of Jālna[13], but were unable to manage without strong guards, and in February 1811 were ordered to rejoin their units [314][14]. Jourdan and Hanson worked round Hyderābād till the end of 1810 [3].

Surveys were made in Berār by Skeffington Lutwidge, who filled in with routes brought in by guides and *harkaras*[15]. Other surveys carried out in the Nizām's territories at this time are routes surveyed by John Sinclair on the south-east frontiers, between Paloncha, Khammammett and Tiruvur[16], and down to Masulipatam[17].

[1] Amner, a fort on Tapti R., 55 C/14 ; Songarh, 46 G/12. [2] MRO. Map 542, and possibly MRIO. 76 (63). [3] B Pol C. 26–6–06 (19). [4] 56 I/8. [5] Wainganga R., 55 O, P. [6] 65 E, F. [7] 65 J/9. [8] Wardha R., 55 L, 56 M. [9] DDn. 68 (125), 9–7–06. [10] DDn. 246 (149). [11] Map, MRIO. 118 (6). [12] ib. 72 (56). [13] 47 M/13 ; Register of Triangles, MRIO. M 159. [14] MMC. 1–3–11. [15] Map, MRIO. 76 (62) ; DDn. 246 (142). [16] 65 C/10, C/4, C/12. [17] DDn. 246 (140, 151).

JAVA, 1811–6

During the Napoleonic wars, the French not only overran Holland, but in 1811 occupied Batavia, capital of Java, which was the chief Dutch possession in the East. As their presence there menaced the Company's scattered settlements in the "eastern islands", the Governor General, Lord Minto, organized a large force, mainly composed of Madras troops, which captured Batavia on 26th August 1811[1]. Stamford Raffles[2] who had first suggested the expedition was appointed Lieutenant Governor of the island, which was held by the Company until restored to the Dutch in August 1816[3].

Mackenzie was appointed Chief Engineer to the expedition, the first division of which sailed from Madras in April under Rollo Gillespie[4]; several officers who had passed through the Military Institution held staff appointments. Mackenzie led the first reconnaissance of the shores of Java, and selected the point at which the force made a successful landing, and further distinguished himself in the operations which followed[5] especially at the capture of Cornelis, where large scale surveys were made by Ensigns Anderson and Sim under his direction[6].

After the withdrawal of the expeditionary force, he remained on special duty under the civil government, being made "President of the Committee for investigating the state of Landed Tenure", and also

> employed...in collecting and arranging the Topographical and Military Reports and Surveys of the former Government [Dutch]; in investigating the History and Antiquities of the Island [278, 304]. ...
>
> The topographical surveys commenced under the late Government have been found to merit every attention, and on the suggestion of Lieutenant Colonel Mackenzie they will be continued partly on the same plan. ... Java must ever be considered as a great agricultural Country, and as the Granary of the Eastern Islands, ... and the information and opinions furnished by Lieutenant Colonel Mackenzie will enable Government...to establish a more enlightened and advantageous system of internal administration[7].

In August 1813 Mackenzie returned to India, and remained in Bengal till March 1815 after completing his reports on Java [83–4, 302]. With these he submitted

> two general Statistical Tables of the population, stock, and lands of the Provinces in Java (no General Inspection of this kind having been executed under the former Government)[8].

Many useful Dutch maps were found and revenue surveys were continued by the Dutch staff [293][9]; but, as might be expected, these were not sufficient for military requirements, and various surveys were put in hand under the orders of Commander of the Forces, now Gillespie. These led to an acrimonious correspondence between him and Raffles [293–4], which was in keeping with the bitter feud which continued between them until Gillespie obtained a transfer to Bengal.

The officers employed on these surveys were William Thorn, in charge of the Q.M.G.'s Department; William Colebrooke, of the Royal Artillery, at first Military Secretary and later D.Q.M.G.; and James Bayley, a graduate of the Military Institution who had been one of Lambton's assistants [242–3]. In May 1813 Thorn asked that Bayley's return to Madras might be delayed as it

> would be attended with considerable inconvenience to the Service from...the unfinished state of the extensive Survey which he had commenced for 10 miles round Batavia, and which he is willing to complete if time is allowed him. A few months longer Residence in Java...would be profitably employed in various other useful pursuits at the same time, such as the finishing of certain Routes...which, having their origin with him, can only be serviceable in his hands for finishing off. ... The before-mentioned Survey was undertaken by him without having any salary or allowance of any kind.

Thorn further mentioned that a survey of his own,

[1] *Conquest of Java*. [2] Thomas Stamford Raffles (1781–1826); Penang 1805–11; Java 1811–6; Kt. 1817; Governor Singapore 1820–4; founded Zoological Gardens, London; FRS.; LLD.; *DNB.*; *DIB.* [3] Formally handed over, 19–8–16; *Java Govt. Gaz.* [4] M. Gen. Robert Rollo Gillespie (1766–1814); *DNB.*; *DIB.*; Hero of Vellore Mutiny, 10–7–06; Nepāl War. killed at Kalanga, 31–10–14; MI. St. Paul's Cathl. [5] *Conquest of Java* (195, 199). [6] Capture of Cornelis, 13 to 26 Aug. 1811; MRIO. 107 (12–25). [7] From Raffles to GG.; 15–7–13; MMC. 17–9–13; GO. Batavia. [8] Mackenzie to Colonial Dept., Ft. William, 14–12–13. MPC. 31–5–14. [9] Raffles I (6); Appx. (clv); J. Cor. 1812–6.

the Topographical Survey of the high Military Road throughout the whole Island. ... had taken up 10 months in the performance, and was entirely executed *at my own Expence*[1].

In reply to Raffles' request for further particulars, Thorn pointed out that his road survey

was made with the *consent* and *full approbation* of the Lieutenant Governor, to whom I had the honor of mentioning the subject in conversation, and who was pleased to offer me every assistance in the prosecution of so useful a work. ... The *first* and *principal* of the Duties of My Department consists in a thorough knowledge, *generally* and *locally*, of all parts of the Country [300-2]. ... I was *aware* that no authentic or Correct Surveys of that nature existed. ...

I had hoped my offer of a presentation of a fair Copy of the Chart (which has cost me two months additional labour and expence) would have been kindly received by the Hon. the Lieutenant Governor. ... The Chart speaks for itself, and I venture to say it would have Cost Government more than five times the sum above mentioned (one thousand Dollars), had it been done by regular Appointment.

Bayley could quote no orders for his "Survey of the Environs of Batavia", but pointed out that in his own presidency, Madras, the Quartermaster General had full authority to appoint his own officers to carry out military surveys [321–2], and added that he could hardly show his sense of duty better than by dedicating my few leisure hours to such pursuit. Raffles however refused to allow Bayley to remain and complete his survey, though he was

fully disposed to concur in an approbation of the Motives which have induced those Officers to execute the Surveys in question, as well as in a liberal renumeration. ... While he is perfectly ready to concur in a Donation of 1000 Spanish Dollars to Major Thorn, if the Commander of the Forces deems that sum proper and adequate, he feels it his duty to request that the Major General will cause the Surveys which have been executed or commenced upon by Major Thorn or Lieutenant Bayley to be transmitted to Government.

He further declared that it was

clearly and unequivocally defined...that the Topographical Surveys of the Island shall be in the charge of a separate Department, ... under the immediate eye of the Government. ... Under the instructions and recommendation of Colonel Mackenzie, some Topographical Surveys have been completed or undertaken, and an Office has been established in the Government House at Buitenzong[2] and at Samarang[3], in which several of the Surveyors of the late Government are entertained [293]. ... The Lieutenant Governor considers the delivery to Government of the Surveys executed by Major Thorn to be absolutely indispensable, as well as every other that is known to exist in any Department of the Service [293–4][4].

Though Gillespie sent in copies of the two surveys, he refused to surrender the original documents or fieldbooks, which he sent off to the Commander-in-Chief in Calcutta, where Raffles also referred the matter;

It is with regret that I am under the necessity of submitting to your Lordship's consideration a correspondence which has occurred relative to certain Surveys executed in the Quarter Master General's Department, ...

At the period of the capture of the Colony, many of the Surveys and Charts of the late Government fell into the hands of the Captors and, although it was my endeavour to collect them for the purpose of being registered and collected under Superintendence of Colonel Mackenzie, I am aware that many of them were not delivered to Government. ...

Some months ago a copy of a Survey executed by Major Thorn was presented to me through a private Channel, and, conceiving that the undertaking might eventually be useful to Government, I did not object to its continuance, although its commencement was not regularly authorized. ... The work of Lieutenant Bayley, however, ... was only just commenced, and there are already accurate and complete surveys of the Environs of Batavia executed by the late Government. I therefore did not conceive it necessary to retain Lieutenant Bayley. ...

It was with extreme regret that I now found the question was rendered a discussion between Government and the Commander of the Forces personally. ... The Documents were still withheld from Government, and there was no security for their being retained in the Secret and Official manner, so clearly and pointedly defined by the Hon'ble Court of Directors [288][5].

Raffles was supported by the Supreme Government [294], but before their reply was received Gillespie had left the island, and there was no further dispute, the

[1] JMC. 28–5–13 (405). [2] near Batavia. [3] 280 m. E. of Batavia. [4] JMC. 23–6–13 (580–658).
[5] ib. 13–7–13 (45).

direction of all future surveys resting with the Lieutenant Governor. After long delay Thorn received his thousand dollars.

At the beginning of May 1812 William Colebrooke had been deputed to reconnoitre the eastern end of the island, and had made sketches of the bay of Pachitan and neighbouring islands[1]; in July he was appointed to survey the Solo River;

I prosecuted the admeasurement of the River in the months of Aug., Sept., & Oct., 1812, under instructions from Maj Gen. Gillespie to execute a Military Survey & prepare a Report upon the practicability of establishing a Military Communication by means of it[2]. The Field Books were made out but, as I was appointed to the General Staff while occupied upon them, the Reports were delayed in order that further Information might be obtained which would render the Survey useful, not only as a Military, but as a Geographical & Statistical work.

On my return to Java in 1815, I applied to the Commander of the Forces that Lieut. Everest (an officer in every way qualified) might be appointed to complete the Task, & from his mathematical & astronomical knowledge the Lieut. Governor was pleased to combine some collateral objects in his Instructions, such as determining the positions & estimating the Height of certain Mountains in the longitudinal Range of the Island[3].

Everest himself reported to Colebrooke later that "In the month of June 1815 I was ordered to Samarang to be employed in Completing a Survey of the Solo River which had been carried on by you in 1812, & on my arrival at Samarang I received" official instructions to survey the river by the most accurate methods possible, preferably by a series of astronomical observations, as the nature of the country would not permit of a regular traverse. He was to examine and report on the possibility of improving the navigation of the river, and from his astronomically fixed points to determine,

if practicable, the exact positions of the Mountains Merappie & Mer Baboo, with the Latitude & Longitude of Solo. ... the result of your observations on these two points should be communicated...without waiting for your general report of Survey[4].

This survey occupied from July 1815 to January 1816[5], when Everest returned to regimental duty.

When final orders came for evacuation of Java and its restoration to the Dutch, Everest was deputed to make a rapid reconnaissance of the harbours and communications on the southern coast. Going to Solo in July, he started by making a survey of the Bay of Pachitan with soundings [138];

Having immediately proceeded from Solo on a second excursion to explore the road, and examine the Bay of Segoree Keddee and other Bays on the South Coast, ... I never allowed myself time sufficient to prepare or digest the materials thus hastily collected. On my return I was attacked with a fever occasioned by the Fatigue I had undergone, and many days thus unavoidably elapsed before I found myself well enough to apply to business. ...

On leaving Batavia I was compelled to purchase a Carriage, being unable to hire one and, having broken it by oversetting in the Hills, the Cost cannot be realised, and I shall thus be a loser of 200 Spanish Dollars. As I proceeded from Chenhon to Samarang by mail, it was impossible to take any cumbersome instruments with me, and my Survey was executed by means of a micrometrical Telescope which I purchased for one hundred Spanish Dollars[6].

Another surveyor who contributed largely to the mapping of Java was Godfrey Baker, an officer of one of the volunteer battalions from Bengal. He made various large scale surveys of fortifications and other sketches for the civil Government during 1812[7], and during 1815 and 1816 made special surveys of the southern part of the island. The following notes are taken from his official letters and his *Memoir of a Survey in the Native Princes' Dominions of Java*[8];

When the British landed in Java, there had not probably been 6 Europeans who had seen more than a few miles of the flat shore 16 miles S. of Djocjocarta. ... In 1815 information was received of the projected restoration of Java to the new throne on the Netherlands, and the necessity of some military memorial and survey of those regions became obvious. ...

Holding a Staff situation in the Native Princes' Dominions as superintendent of the Forts,

[1] Mack MSS. 82 (167–71); Blagden (238–9). [2] cf. Raffles, I (6). [3] BMC. 6–12–16 (26). [4] Instructions dated 13–7–15; BMC. 6–12–16 (27–8); cf. De Haan, vol. 92, part 4, p. 543, *Bijdragen tot de taal land, en Volkenkunde van Nederlandsch Indie*. [5] Plan of Solo R. by Colebrooke & Everest, MRIO. 177 (11); other plans by Everest, ib. 105 (35); 106 (50); 108 (29). [6] BMC. 29–11–16 (21). [7] JMC. 15–1–13 (88). [8] IO Maps, MSS. 24.

Public Buildings, and Roads, I had some time occupied my leisure in a private survey of some parts of the Country.

On May 19th he received instructions from the Lieutenant Governor ;

An accurate description of the South coast accompanied, where practicable, by sketches of surveyed routes, is the first point to be attended to. ...

The Dutch Maps of the Native Provinces are altogether so erroneous & imperfect as to offer no guide whatever ; it is therefore of some importance that whatever information you may collect, and whatever routes you may make across the country, should be accurately laid down in a General Sketch map of these Provinces. I am aware that we cannot look for anything like geographical accuracy without a regular Survey, but this is impossible to undertake at the present moment ; and your sketch of such parts of the Country as you may actually visit, and corrected by the best local information you may obtain, cannot fail to prove highly interesting[1].

Baker reports ;

I left Solo on the 20th of June 1815, proceeding through Djocjocarta to the South coast at Manchingan. Here I continued close along the South Coast Westward, more than one hundred and ten miles to Chilachap, of which Harbour and its vicinity I made a Survey on a very large scale. This done, I passed through the long narrow strait laying between the main Java Shore and the Island of Mossobambangan, and which connects the Bay of Chilachap with that of Sigoro...and the superb Harbour of Chipalat. ... Of this connecting strait I merely took an eye Sketch and soundings, so as to establish its practicability for Sloops, ... but of the Manting Mati, or Chipalat Bay, I took a Survey on the same extensive scale as the Eastern Bay. ...

Returning to Chilachap, as my Instructions restricted me to the Dominions of the Native Princes, ... I proceeded by water, sounding, and taking an eye Sketch of the River Donan. ... Although I had before made a private survey of the main route...to Sourabarta, yet for the sake of correctness I was induced to continue it backwards with some variations from my former route. ...

I continued the Survey Southward to Djocjocarta, which completed an extensive circuit of about 400 miles along all the main Communication of the interior of Java, with offsets either by actual Survey or the best information procurable. ... It was then the end of October and, the Rains settling in, I prepared myself to arrange and unite the whole of the materials collected in a proper form.

He was now called back to command his corps, till

on the 15th June last [1816] I received an order...to return to my former employment, and to complete my enquiries and Surveys[2]. In July last I surveyed and laid down the whole route to Pachitan ; ... arrived at Pachitan I found Lt. Everest of the Artillery employed specially on the survey of that Harbour by the Commander of the Forces [137] ; this would not have prevented me from taking a more regular survey, had it not been that on July 27th I received a letter of recall, and reached Solo the 31st[3].

In giving a full list of the material he had collected, Baker includes

A Fieldbook or Journal containing my route surveys through the Island, ... connected when practicable by observations with the Theodolite, at the end of each day's route, of the bearings and angles of the principal mountains of Java[4].

He adds a list of ten of these mountains with their latitudes and longitudes as fixed by Everest ;

I believe Captain Everest also took altitudes & bearings, from Solo the Capital, of these mountains. They are very lofty Volcanoes [87]. To judge by the eye I should say they vary from 6 or 8 to 10,000[5].

In October 1816 Baker took his reports and surveys to Calcutta where he spent several months finishing them off[6]. Amongst his maps[7], which are beautifully neat and clear, is one copied by him from an original made " by the young Regent of Galoo ", a Javanese[8].

[1] from Raffles, 20–5–15. [2] Report 15–8–15 ; BSC. 5–10–16 (2). [3] Journal ; IO Maps, 24 ; MRIO. M 439. [4] MRIO. M 436. [5] IO Maps. MS. 24. [6] BSC. 7–12–16 (10). [7] MRIO. 106 (34–5, 41–2, 46) ; 108 (32–4), etc. [8] ib. 107 (1).

CHAPTER X

CARNATIC DISTRICTS

Revenue Surveyors — Dindigul & Madura — Tinnevelly — Tanjore, 1805–10 — Pudukkottai, 1813 — Trichinopoly, 1806–10 — Coimbatore & Nīlgiri Hills, 1806–13 — Nellore & other districts — General Maps, 1812–6.

THE district surveys carried out by the Assistant Revenue Surveyors from the Observatory Surveying School were to comprise a general topographical survey of each district, followed by a detailed revenue and statistical survey that should give the Collector all the information he might want for administrative purposes [I, 145–7]. In some cases surveys were made under the control of the Superintendent of Tank Repairs with a special view to the improvement of irrigation, but as a rule the Surveyors worked directly under the Collectors, though receiving professional instructions from the Inspector of Revenue Surveys, an office held by the Astronomer at the observatory [I, 285 ; II, 2].

Though the Superintendent of Tank Repairs made occasional visits to the surveyors in the field [144–5], the Inspector of Revenue Surveys never did so, but confined himself to providing professional instructions, instruments, and equipment —collecting and compiling regular quarterly reports—compiling general maps— and giving fatherly criticism. He was at the same time Superintendent of the Surveying School, and therefore responsible for the early training, and posting, of the surveyors.

Lambton helped whenever he could ;

> I have always furnished the Revenue Surveyors with data in the different Provinces through which I have passed, so that most of the Provincial Surveys will have their foundation on this work [145, 150][1].

On the appointment of Mackenzie as Surveyor General from 1st December 1810, the post of Inspector of Revenue Surveys was abolished, the Surveying School closed down, and the surveys in progress, other than those for the Tank Department, transferred to the professional control of the Surveyor General[2], [I, 107–8];

> Six of the Assistant Surveyors, or the apprentices, might with advantage...be attached to the Department of Tank Repairs and Watercourses, which is of so much importance to the cultivation of the country ; ... the services of those who have already been employed in that branch have been very useful in carrying on its details. ...
>
> It is also the wish of the Governor in Council that one of the Assistants should be permanently attached to the Collector of Madras[3].

By 1812 the Department of Tank Repairs had made surveys in "Tanjore, Trichinopoly, Arcot, Tinnevelly, Coimbatore, Jaghire, & Nellore" [149][4].

Dindigul & Madura

In 1796 three of these boys had been sent to Dindigul [I, 285, II, 350, 352], which had been under the charge of an English collector since 1790, and was later absorbed into the district of Madura, which passed to the Company in 1801 [I, 107 n.6].

[1] DDn. 63 (229), 24–7–10. [2] M Rev Bd. 20–12–10. [3] ib. 7–2–11. [4] DDn. 127 (328), 30–7–12.

The Board of Revenue write in 1807 :

We have lately received a map of the Province of Madura, the Pollams of Nuttam, Dindigul, Madura, and Manapara, executed by the Surveyors attached to Mr. Parish [142 n.4] this work has been inspected by the Superintendent, who remarks that it will prove a very valuable addition to our present Topographical knowledge of these countries, when supported by a series of Triangles necessary to prove its accuracy[1].

The Superintendent's inspection did not go beyond a scrutiny of the maps sent in to Madras, and Warren had to report later that

Johnson...has not given in the Madura District that satisfaction to Captain Caldwell[2] [I, 321] which he had a right to expect from him[3].

The Plan...was sketched several years since, in a very desultory manner, by J. A. Johnson ; it is now presented in a more eligible form, being properly supported by Triangles.

This work however is of no great importance, and far unequal to what might have been expected from an assistant of his standing in the service [I, 284], assisted as Johnson was by another boy [Pereira]. The plan was sent in October last, since which time he has done nothing in the way of his profession ; Mr. Parish seeing him thus unoccupied, has employed him as a Writer in his cutcherry [141]. ...

The Survey of the Tanjore District is likely to be completed by the month of July next. I would therefore recommend that so soon as this is effected, Turnbull with his two Sub-Assistants be directed to proceed to Madura with a view to hasten the conclusion of the Survey, ... and that Johnson be recalled to the Presidency that he may not interfere with the Surveyors who are to replace him[4].

It was of the Madura survey that Mountford wrote in 1819 ;

The Survey of the Southern, or Darapooram, Division which you represent as being extremely imperfect, and no reliance can be placed upon the Map, ... was...executed so far back as 1801–02–03 by young lads sent from the Surveying School, and upon a much smaller scale than it has been thought necessary to adopt in a more recent date[5].

In 1810 Turnbull took over the Madura survey, and by 1813 he and his assistants had surveyed the Sivaganga *zamīndāri*, Tirupattur[6], and the northern part of Rāmnād, carrying down in 1814 to Rāmeswaram and the neighbouring islands, which then formed part of the Madura Collectorate[7] [145].

In 1815 he resurveyed Dindigul[8]. In recommending this it was explained that the resurvey completed in 1801 had been lost [151], and that, considering the inexperience of the young men at that period, the loss was probably of no great importance[9].

A section of Turnbull's resurvey, scale one inch to a mile, which covered most of the cultivated area, is reproduced as plate 13, and shows one of the best of these district surveys[10]. The party suffered greatly from fever, and survey was broken off in 1816, to be completed five years later.

TINNEVELLY

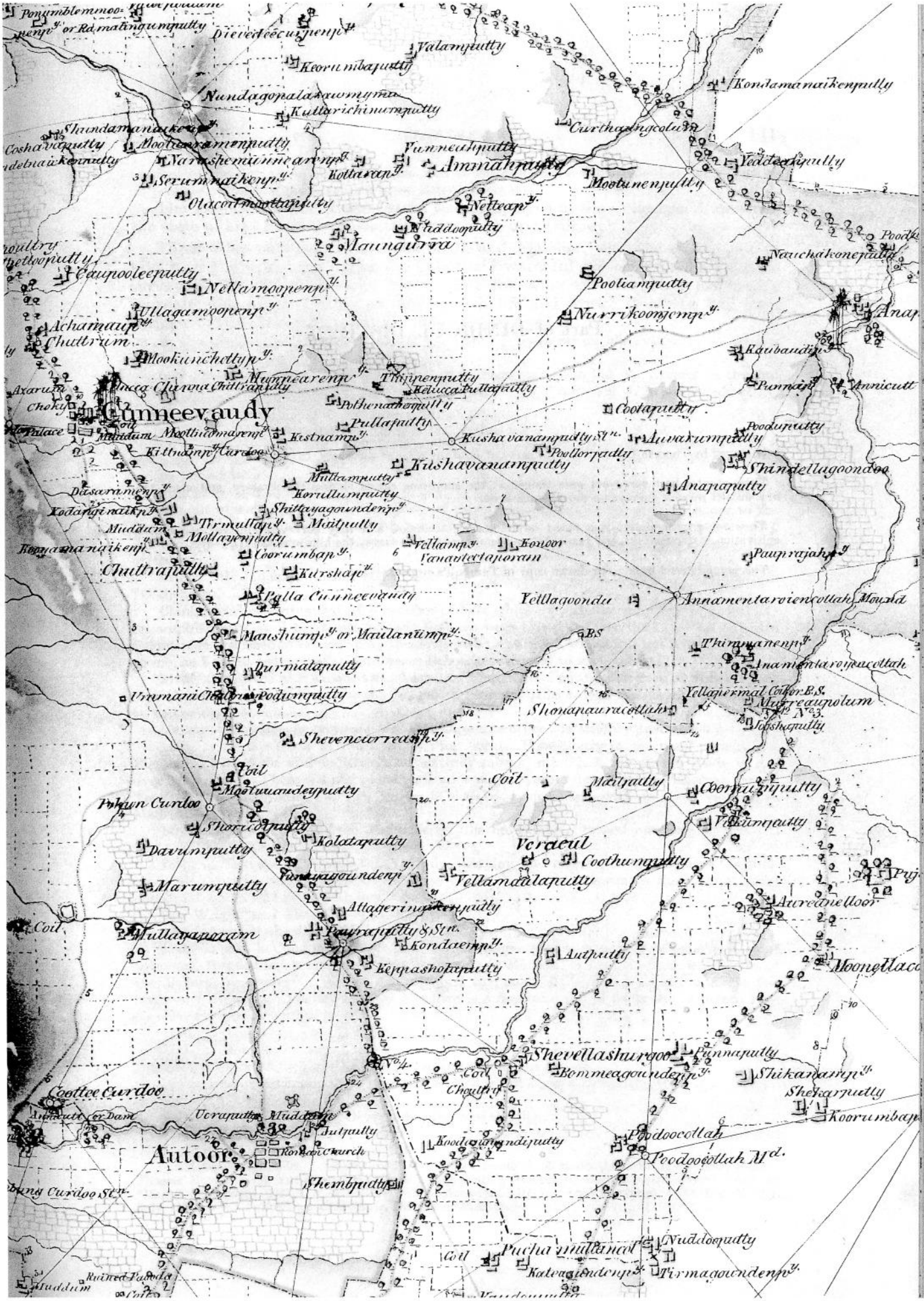
Although two boys from the School were posted to Tinnevelly in 1801 when the district was taken over by the Company they had accomplished very little when the Collector, James Hepburn[11], reported in November 1806 ;

The work is, as yet, in no greater progress than the principal points in the District being ascertained, although these Assistant Surveyors have been employed in the District from the time of the assumption of the Carnatic [I, 107 n.6].

Since my arrival here, I have employed Andrew Read [142] in preparing a General Map of the District from the result of his own survey, and from some other original documents which I have been lucky enough to procure.

As a particular survey of this District is for many reasons very desirable—As the Monthly expence attending these people is considerable—As the survey has hitherto gone on very slow—and from certain other circumstances attending Andrew Read—I request that...the Superin-

[1] Fdbks. MRIO. M 56, 67, 69, 87, 95 ; *IO Cat.* (357) & MRO. Map 152. MRC. 16–1–07. [2] Inspector of Tank Repairs. [3] M Rev Bd. 26–4–08. [4] ib. 12–4–10. [5] DDn. 148 (225), 29–11–19. [6] 58 K/5, & J/12 ; DDn. 127 (159). [7] Fdbks. MRIO. M 93, 94 ; Maps, ib. 136 (44) & MRO. Map 159. [8] Map, MRIO. 146 (13). [9] Resurvey sanctioned, MPC. 9–12–14. [10] MRIO. 3–PT–15, in 7 sections. [11] MCS. ; Writer 1796 ; Collector Tinnevelly 1806 ; Tanjore 1813 ; furl. 1820 ; ret. 1824.


Cunneevaudy
Autoor
Veraeul
Shevellashurgoo
Kushavanampatty
Annamentaroiencottah
Shonapauraicottah
Kolatapatty
Davumpatty
Marumpatty
Mullayaparam
Kepphasholapatty
Coottee Curdoo
Mootuvandeypatty
Shevencurreapy
Durmalapatty
Chultrapatty
Kurshapy
Coorumbapatty
Mallayenpatty
Kurshapy
Kistnapy
Pullapatty
Kittnapy
Mullapatty
Kondaenpy
Shembpatty
Coil
Choultry
Ruined Pagoda
Huddum
Tirmagoundenpy
Kalvagoundenpy
Pucha mullanoil
Nuddoopatty
Poodoocottah
Poodoocottah Md.
Shikarapatty
Shellarpatty
Koorumbapy
Moonellaco
Aureddielloor
Vellamdalapatty
Coothumpatty
Vellampatty
Coorumbapatty
Maitpatty
Coil
Vellaiermal Coikon B.S.
Murreapolum
Tirmullapy
Maitpatty
Vellagoondu
Vellamp
Eonoor
Vanavetchaporam
Paupparajahpy
Anapapatty
Shindellugoondoo
Kaibandipy
Nurrikoonjempy
Poolampatty
Nellamoopenpy
Caupooleepatty
Maungiwa
Nattcappy
Moolunenpatty
Kollarappy
Vunneallipatty
Curthadugcolu
Kondamanaikenpatty
Nundagonalaswamymo
Kutlarichimunpatty
Keorumbapatty
Valampatty
Pievedeecupenpy
Ponumblemmoo
Ramalingumpatty
Shundamanaikenpy
Mootanaramenpatty
Coshavapatty
Seruvanaikenpy
Otacoilmuttapatty
Achamaupy
Chattrum
Mookunchettypy
Uttagamoopenpy
Axarutty
Choky
Palace
Mandum
Dasarapenpy
Kodangiparkenpy
Muddum
Komaranaikenpy
Ponnaiyagoundenpy
Shittayagoundenpy
Mullampatty
Korrullumpatty
Pothenachenpatty
Pullapatty
Kistnapy
Kittnapy
Curdoo
Thippenpatty
Kalluca Pullapatty
Poodurpatty
Poollorpatty
Kushavanampatty
Coolapatty
Annicutt
Punnaipy
Nauchakonepatty
Poodi
Anap
Thirumanenpy
Inamembaroiencottah
Vellaiermal Coikon B.S.
Murreapolum
Tosshapatty
Vellampatty
Coothumpatty
Vellamdalapatty
Aureddielloor
Moonellaco
Pannapatty
Shikarapatty
Shellarpatty
Koorumbapy
Poodoocottah
Poodoocottah Md.
Nuddoopatty
Pucha mullanoil
Kalvagoundenpy
Tirmagoundenpy
Bommeagoundenpy
Shembpatty
Ruined Pagoda
Huddum
Coil
Choultry
Kondaenpy
Kepphasholapatty
Pauraipatty & Syn.
Allagerinaidenpatty
Vunnaiyagoundenpy
Vellamdalapatty
Coothumpatty
Veraeul
Vellampatty
Coorumbapatty
Maitpatty
Coil
Mootuvandeypatty
Pulvun Curdoo
Shevencurreapy
Durmalapatty
Manshumpy or Maulanumpy
Chultrapatty
Kurshapy
Palla Cunneevaudy
Mallayenpatty
Tirmullapy
Maitpatty
Kistnapy
Pullapatty
Kittnapy
Curdoo
Mullampatty
Korrullumpatty
Shittayagoundenpy
Kodangiparkenpy
Muddum
Komaranaikenpy
Dasarapenpy
Pothenachenpatty
Thippenpatty
Kalluca Pullapatty
Mookunchettypy
Uttagamoopenpy
Achamaupy
Chattrum
Axarutty
Choky
Palace
Mandum
Cunneevaudy
Nellamoopenpy
Caupooleepatty
Maungiwa
Nattcappy
Moolunenpatty
Kollarappy
Vunneallipatty
Curthadugcolu
Kondamanaikenpatty
Nundagonalaswamymo
Kutlarichimunpatty
Keorumbapatty
Valampatty
Pievedeecupenpy
Ponumblemmoo
Ramalingumpatty
Shundamanaikenpy
Mootanaramenpatty
Coshavapatty
Seruvanaikenpy
Otacoilmuttapatty
Poolampatty
Nurrikoonjempy
Kaibandipy
Punnaipy
Annicutt
Nauchakonepatty
Poodi
Anap
Coolapatty
Poodurpatty
Shindellugoondoo
Anapapatty
Paupparajahpy
Vellagoondu
Annamentaroiencottah
Thirumanenpy
Inamembaroiencottah
Tosshapatty
Shonapauraicottah
Shevencurreapy
Durmalapatty
Manshumpy or Maulanumpy
Palla Cunneevaudy
Chultrapatty
Kurshapy
Coorumbapatty
Mallayenpatty
Tirmullapy
Maitpatty
Kistnapy
Pullapatty
Kittnapy
Curdoo
Kushavanampatty

Part of DINDIGUL DISTRICT

Surveyed by Thomas Turnbull and his party of assistant revenue surveyors, 1815–6 [140].

These country-born surveyors were trained at the surveying school Madras Observatory, and made the first district revenue surveys on the one-inch scale.

Their minor triangulation was based on Lambton's triangles, and they surveyed villages, boundaries, cultivation, water-features, and roads. but were not expected to survey the hills in detail [145–6].

This is reproduced from a fair-drawn copy of Turnbull's original.

tendent of the Surveying School...relieve him at the same time with the other, and that he do provide me with two active intelligent lads in their stead.

The second surveyor, Duke Orton, was "employed in the Collectors' Cutcherrie the state of his health not permitting him to go upon survey[1]".

Three other surveyors, Robinson, Hill, and Fletcher, were thereupon sent to take over the work, and under the Collector's watchful eye completed a valuable survey during the next seven years. The following extracts from Robinson's journals[2] give an interesting picture of their life and work; Robinson had been acting as assistant instructor at the School [341, 352].

At the Observatory, Madras, January 1st 1807. [Temperature observations five times a day].

Left the Observatory Garden and removed to Johnson's [140] at St. Thomé[3] on the 2nd of January 1807 at 10 a.m.—Thursday 8th January. At 9 a.m. left J. A. Johnson's at St. Thomé after breakfast. ...

[describes the road in detail, with distances].

At 4 miles and 6 furlongs 100 yards, we meet the spot on which they intend to erect a Senetaph[4] to the memory of Lord Cornwallis [31 n.1], which is opposite the 4 miles stone on the Mount Road. ...

Vandalore Hill and Choultry at 18 m. 2 f. 12 y.[5], & at 30 yards to the right of the road is a well built upstair house for the reception of travellers, which does the greatest honor to the founder of it (General Smith), as it is an excellent retreat to the unweried traveller [*sic*]. Arrived at this place at 3 p.m. after a fatiguing march of 6 hours through the burning heat of the sun.

Friday 9th January. ... Met Mr. J. Cochrane[6] here, who was on his way to Madras from Pondicherry. ...

Chinglepett[7] is surrounded by a number of hills which at a Distance appear beautiful like an amphitheatre. ... I must also remark that we were this day [worried ?] by an old mad fellow, who promised to rob and play the devil with us at night, which was not a little alarming to me, as I was a new traveller, and never before accustomed to such threats. ...

11th. ... Arrived at Permacoil at 10 a.m. ... Fletcher & I got up this rock at about 4 p.m. Saw the range of Mountains...to the N., also a range of Hills to the W., which we supposed to be the Hills at Salem. ...

Met two gentlemen surveying; Mr. Tulloch and another [of Military Institution].

12th. ... At 5 o'clock in the evening rode out to Pondicherry in company with Hill & Fletcher. The Walls of Pondicherry are entirely raised [razed], & the plough made to run over the ruins. ... There is a plain here with an avenue all around and seats at intervals for the Tete a Tete of the evening [*sic*]. The sea is close by, & surf beats with as much violence as Madras.

14th. ... Set out early from Pondicherry this morning; ... missed our way at first; ... met two French Vagrants. ...

15th. ... Travelled 25 miles 2 f. 112 yds. this day and arrived at the town of Chellumbrum[8]; ... crossed several large rivers, some of which contained water in them about waist deep, and which we forded with our horses. ...

Saw Wright[9] and Allan [149] at this place.

16th. ... Spent the day at Wright's.

17th. ... Met a Conductor & several Gun carriages with a company of sepoys & some prisoners, Handcuffed, whom they were conveying to Madras. I imagine these to be some of the Vellore run-aways[10]. Wright accompanied us [part of the way]. ... Put up for a few hours at a Braminy Choultry in front of which is a fine tank full of water and a tavern kept by a Portuguese...close by.

19th. ... The lascar lost his child this day. ...

21st. ... Met the Madura Treasury going to Madras on a large heavy cart drawn by 12 Bullocks, & escorted by three or four Peons and a guard of sepoys. ...

We arrived at Trichinopoly at about 12 o'clock & put up at a Braminy's House. ... Gabriel the servant got sick on the 20th.

Friday the 23rd at noon. Observed altitude of the Sun.

Got acquainted with Mr. Sutherland, a shopkeeper at this place[11], & saw Mr. William Scott

[1] M Rev Bd 24–11–06. [2] MRIO. M 12. [3] on sea front, S. of Madras, not to be confused with St. Thomas' Mount. [4] Robinson's spelling retained throughout. [5] Obviously keeping perambulator throughout. [6] Magte., N. Kanara, 1806–7. [7] 57 P/14. [8] Chidambaram, 58 M/11. [9] not identified. [10] Vellore Mutiny, July 1806. [11] J. Sutherland, shopkeeper, Madras, *EIR.* 1811.

an old schoolfellow of mine, with whom I had the pleasure of dining with the day before we left the place. ... Could not see Silvester [Pope] although I had written to him [150].

26th. ... Left Trichinopoly. ... Fletcher parted company with us...as his route was for Dindigul.

27th. ... Met Capt. McDougall[1]...who wrote to us in the evening for to produce our Passports[2]. We accordingly dressed ourselves & went to him ; he spoke very kindly to us & put a few questions respecting our journey etc., & asked us to drink some wine and water.

29th. ... Reach Madura. ...

Went to Mr. Parish[3] on the 30th & enquired of him where Mr. Hepburn might be ; who told us he was at Shevalpetra. ... Intended to hire a bullock coach as Hill's Horse was grown too bad for him to continue his journey any further on it, but Mr. Burby[4] was so good as to lend us his to go on as far as Shevalpettoor[5]. Hill's horse got sick through fright at the fireworks at Seringham[6], which we had been to see when we were at Trichinopoly.

Sunday, 1st February. ... Left Madura ; ... prevented from measuring the distance as the lascar did not bring up the perambulator with us.

3rd. ... Lost our road & the lascar not up with us in time with the perambulator. ... Dressed ourselves & went to Mr. Hepburn in the evening, who desired us to attend at his Cutcherry[7] the next day at 11 o'clock.

4th. ... Attended on Mr. Hepburn at his Cutcherry at the appointed time. He put a few questions to me ; such as, whether I was ever employed under anybody before, &c. He desired us to call again next day at about the same time.

5th. ... Saw Mr. Hepburn again ; he told that he had written to Mr. A. Read [140] at Palamcotta to come down with all his instruments, &c. ... Saw Read at night. ...

6th. ... Saw Read again today ; he told me that Mr. Hepburn had desired him to deliver up all his instruments &c., to me. Pitched his Marquee and removed to it. ...

13th. ... Mr. Hepburn sent for me, to look at all the instruments that I had belonging to the Company. I informed him of my intention of going to Palamcotta to examine Read's base, and then to begin upon anything he would wish me to do there ; in reply to which he said he had nothing for me to do, and that I might begin with the particular survey whenever I thought proper. Spoke to him about Hill's horse at which he did not seem pleased.

Observations & computations of a time by meridian altitude & sun. Mr. Hepburn gave us two Peons to see us supplied with everything on our journey. ...

17th. ... Mr. Hanbury[8], the Asst. Collector, sent for me & questioned me about Hill's Horse, &c. I informed him of my intention of going away to Palamcotta tomorrow. ... He said...that I had better begin with the River for Mr. Hepburn, and then proceed upon the General Survey of the District ; that Capt. Caldwell was expected, & that I am only to remain here for 8 or 10 months. Read is off to Tinnivelly today. ...

20th. ... Saw a man with a Tyger's skin today ; he told us that he was taking it to the Collector's where he would get 5 Pagodas[9] for it, and that it had destroyed 4 men before they could get at it. ...

Arrived at the Collector's house (Tinnivelly) at 7 p.m.

Sunday 22nd. ... Hill went over to Read early this morning & requested of him to show him his base, which was readily agreed to ; Hill arrived by about 11 a.m. ; he told me that the base was over very uneven ground. Received a Letter from the post from Lt. Warren which was extremely afflicting [347]. ... Busy writing today.

23rd. ... Went over to look at Read's base ; the extremities of which are on rising ground and over very uneven ground. ...

Went to Mr. Stratton with Mr. Warren's letter ; he gave me a Plan of the Tinnivelly District (done by Orton), which he wanted me to correct. I intend to make a fair one for him. ...

24th. ... Hill finished copying my remarks on the Road ; as for myself, busy writing letters to Madras. Received Johnson's theodolite for Mr. Hanbury at Shevalpettore, which was sent for him by Mr. Hepburn from Madras. Pasted paper for the plan for the Judge.

25th. ... Begun tracing & colouring the Plan for the Judge ; at home all day ; saw the Papers but nothing surprising in them.

26th. ... Busy drawing Mr. Stratton's Plan, & Hill in writing Read's angles to my book. At home all day.

Sunday March 1st. Finished Mr. Stratton's Plan & delivered it to him ; he was greatly

[1] John MacDougal (1775–1813); Mad. Inf. 1795. [2] All Europeans except civil officers within their own districts & military officers with units, required passports. [3] George Parish (1780–1839); MCS. 1796. [4] Conductor Daniel Burby. [5] Shevelipootoor [pl. 16]. [6] Srirangam, 58 J/9. [7] Court House. [8] John Hanbury (1788/9–1834); MCS. 1804. [9] About 17 Rupees [I, 278 n.7].

pleased with it, & bid me refer to him in case I should ever be at a loss for anything. ... Met Mr. Anstey & Lady as they were going out airing[1].

3rd. ... Pitched Flags &c., on my intended Base. Not well today also ; Received a note from Mr. Hanbury concerning my abstract[2]. Got a new glass put on to Read's theodolite as I had broken the old one.

4th. Hill & I begun to measure the Base very early this morning, which we got prepared yesterday. ... Length of Base 143 chains. Not trusting to this measurement alone, we went out in the afternoon at ½ past 3, & measured till ¼ past 6 o'clock. ...

6th. ... Fixed stone at W. end of base corresponding with that at E. end.

After making observations on neighbouring hills for the connection of his base, Robinson made a short theodolite traverse along the banks of the river[3], and then received orders

to go down to the sea (at the mouth of the River) & take a series of Levels along one bank of the River for Capt. Caldwell [140].

19th March. ... Busy marking out the Divisions on two ten-feet rods & in getting sight vanes made for them, as I am to proceed to the sea to commence levelling. ...

[continues levelling for several days].

23rd. ... Prevented from Surveying in the Forenoon as it was a feast day with the natives, but went out in the evening at about ½ past 3 p.m. and surveyed. ... We were complimented in the forenoon with the visits of several dancing girls.

24th. ... Theodolite Traverse. Computations of Southings & Westings. ... Came home a little after 12 o'clock & took breakfast. ... Bothered by Dancing Girls again. ...

Good Friday, 27th March. Went out this morning very early to survey by myself. ... Came home quite fatigued in the heat of the sun, & was obliged to trudge a great part of the way on bare foot. ...

Easter Sunday. Went out very early this morning to survey, did but little & came home by about 9 a.m. ; a great deal of trouble at night in getting collies &c., to remove our baggage, as the best part of the people were taken off to remove Mr. Hepburn's things ; he being on his way to Alvar Tinivelly[4] from Tuticorin. ...

1st April 1807. ... Went out surveying by myself this morning ; left Hill at home to work at his plan. Mr. Hepburn met me this morning about ¼ of an hour after I had begun with my survey ; he put a few questions to me &c., and desired me to bring up the survey as far as Alvar Tinivelly, as he has something to say to me. Day excessively hot ; finished this days work as far as the Collector's tents. ... Did more today than any other day. ... I hear that Fletcher is to be here shortly.

2nd. ... Went to Mr. Hepburn with my Plan after breakfast ; he appeared to be pleased with it & desired me to continue it up to Tanpanatum for Capt. Caldwell, who is expected here shortly. ...

5th. ... Finished my Plan & took it to Mr. H–n ; ... told him that I intend to commence surveying from tomorrow. I am desired to carry it on as far as an anicut which is about 13 miles higher up, & to note down everything particular. ...

In coming from Mr. Hepburn's Tents on the N. side of the river to...the opposite bank, My Horse, contrary to his usual mode of stooping to drink, laid completely into the water while I was on him, saddle and all, leaving me wet into it.

[Fletcher joins from Madura on April 20th].

30th April. ... Arrived at Tuticorin at about 9. Saw Mr. Hepburn at 11 & requested him to give me leave to go back to Madras, at which he appeared to be displeased ; ... advised me to consider on it, and to come to him the next day at about the same time.

Bad with a severe headache at night.

1st May. Saw Mr. H–n today ; ... spoke to him again to the same purpose of letting me go ; he desired me to write to him for leave of absence, and that he would give me a letter for Capt. Warren. ... Saw Orton today.

3rd. ... Left Tuticorin at 3 p.m. & arrived by 12 at night at Alvar Tinivelly.

7th. ... At Palamcotta. Wrote Mr. Hepburn for a Passport for to proceed to Madras. ...

10th. ... Wrote public letter to Madras for my discharge from the Service. ...

15th. ... Received a very impertinent letter from Fletcher.

17th. ... Went to church today.

18th. ... Hill & Fletcher off this evening to survey.

20th. ... Bought Mr. Copland's[5] Palanqueen for 23 Pagodas, which I have promised to pay

[1] Thos. Anstey (1770–1843); MCS. 1789; m., Madras. 2–8–01, Miss Frances Montresor; Commercial Resdt., Tinnevelly, 1806–11. [2] Pay bill. [3] Tambraparni R., 58 H/6 to L/2. [4] Alwar Tirunagiri, 58 H/14.
[5] not identified ; not MCS.

him at the end of the month. Left Palamcotta at about ½ past 5 this evening.

On 21st May Robinson resumes surveying, traversing, and levelling, for the first time since 14th April, and continues till 3rd June ;

4th June. ... This being King George's Birthday, a Royal Salute of 21 guns was fired at the Fort of Palamcotta. Mr. Hepburn sent for me this morning & was extremely angry at my not going on with the Survey ...

23rd. ... Panpanussum at the foot of the Ghauts[1] ; ... cataract ; Pagoda ; ... The fishes at this place are so tame as to Eat out of one's hand when rice is given them, and to see them scrambling and jumping over one another for food produces a pleasing sight.

25th. [Measures a short base and takes the height of waterfall, 102.77 feet][2]. Having completed the survey of the River, I left Panpanussum. ...

29th. [Hands in his Plan and fieldbook to Mr. Hepburn at Tinnivelly].

30th July 1807. ... Coutalum[3]. ... Shew Mr. Hepburn our Plan and Fieldbooks, all of which he appeared perfectly satisfied with.

Mr. Hepburn's Garden is situated near the Hills, where it commands a beautiful prospect of the cataract which is not far off ; ... I am desired by Mr. Hepburn to call upon him when he comes to the Cutcherry, and also to find the height of the waterfall for him. Saw Mr. H–n. in the Cutcherry ; he shewn me a letter that he had received from the Board[4] wherein my discharge is granted ; but am advised to write to him to be re-admitted into the Service, & have in consequence done so.

Fletcher is desired to proceed to Mailore to survey a piece of ground for the Revd. Mr. Ringletobe, to which place he intends to set off tomorrow.

Capt. Pepper has requested me to make him out a Plan of the situation of the different Polygar Forts in the Tinnivelly District. ...

8th August. Sent for by Mr. Hepburn to day and desired to proceed to Coilpatnam[5] to survey some lands for Mr. Young, and to note what land has been cleared, how long it had been so, and whether once cultivated[6]. ...

20th. ... Survey the road to Courtallum. ... Day hot and sultry ; found myself somewhat fatigued, as I had made a circuit round the ground.

One of the labourers employed in clearing the jungle was severely wounded in the forehead & right ear by a Bear which attacked him in the open day, as he was refreshing himself with water. ...

28th. ... Mr. Hanbury sent for me to know whether I wished to return to Madras again ; answered him in the affirmative, that I had a great desire to return. Went over in the evening to see Mr. Hepburn.

There is no record of any visit to Madras, and Robinson and Hill continued their rambling surveys—completing the limits of Mr. Young's garden and his cotton farm at Vepulcotta—measuring the height of Comorin Point—and surveying the "Chittaur River[7]" from its junction with the "Taumbrapoorney River[8]".

After 8th December 1807 survey is continued in another book, and from 8th July to 18th August 1808 Robinson was making a continuous traverse survey, cutting in village sites[9]. He was inspected by Caldwell early in the year, Warren's report reading ;

Robinson continues actively employed in the Tinnivelly District, and would have sent copies of his further labours had not Captain Caldwell's visit to that District required all his time and attention. However, as his practice cannot be checked by a more competent judge, and his labours applied to better purposes, the delay cannot be regretted.

Hill employed on a particular survey of the Brearmadusum Talook.

Fletcher surveying the Road from Palamcottah to Arumbully [132], and a piece of ground for Mr. Young ; during this last quarter this Assistant has made but very slow progress in his work, and is at present under the order of Captain Caldwell[10].

In 1810 Hepburn reported the completion of the survey of several *tāluks* in the north of the District ;

[1] Pāpanāsum, 58 H/6, place of pilgramage, *Imp Gaz. Mad.* II (287). [2] Sheet 8 of MRIO. 2-PT-13 shews "stone at Waterfall". [3] Kuttalam, 58 H/1. [4] of Revenue. [5] Kāyalpatnam, 58 L/2, on sea coast. [6] Sheet 15 of MRIO. 2-PT-13 shews two areas south and east Calcaud, Kalakuddu, 58 J/4, marked "Mr. Young's". [7] Chittār R. 58 H/5 to 13. [8] Tāmbraparni R.; MRIO. 162 (4–22) original protractions, scales 1000, 2000, 4000 yds. to inch. [9] Fdbk. *Survey of Alwar-Tinivelly Talook ;* April–July 1808. [10] M Rev Bd. 26–4–08.

When I acquaint you that this detailed survey was commenced and continued for several months under the immediate inspection of Captain Caldwell (who was so kind as to take that trouble at my request), and that in its further progress it was examined into, and carried on, by Major Lambton (also at my desire), who expressed his approbation both of the correctness with which it was executed as also with the diligence of those employed on it [139, 244], I conceive that I am giving a much better testimony in favor of the Surveyors now serving in the Province than anything I could say from myself.

I shall only add that a regular diary of their work is rendered to me weekly, from which I am fully enabled to Judge of their particular labours for each day in the course of it[1].

Three months later Warren submitted several plans constructed by John Robinson, assisted by T. Hill and W. Fletcher[2], employed under the Collector of Tinnivelly. These young men...have had the powerful assistance of Major Lambton and Captain Caldwell[3]. ...

Of this work I shall only observe that Robinson and his Assistants have done more in six months time than Read and Orton during seven years that they were employed in the same District previous to my taking charge of the Department. Robinson's performance being supported by the favorable testimony of Mr. Hepburn as to general conduct, I have been induced to present him with the honorary Medal for 1810 [347][4].

In May 1811 Hepburn had to report that the Revenue Survey is now, and has been for some time past, entirely at a stand in this Province, owing to all the three Surveyors having been seized with fevers while in the execution of their duty ; for this reason Fletcher has not yet set out for Madras, not being at present in a state to move. ...

Robinson and Hill have been at this place for some time, and are now so far recovered as to make me think they will be able to resume their duties in the course of a short time[5].

The survey was completed in 1813[6], Robinson writing to the Surveyor General ; I have compleated with defining the Western Boundaries of this district, as also the obtaining the situation of all the passes. ... I shall proceed towards the survey of part of the Ramnad country[7].

He asked in October how he should send in the maps and papers of the survey which made two cooly loads, and could not go by post, as "it would retard the whole of the Public Mail[8]. He eventually handed them over to the Collector, and proceeded himself to Rāmnād, whilst Hill returned to Madras sick.

Protractions and reductions of this survey are preserved in 18 sheets, some of which are paste-ups about 8 feet by 4[9]. They shew base-lines and rays of minor triangulation, some points being marked "p.t.". No attempt was made to survey the range of Ghāts to the west, but isolated hills in the plains are well shewn. Robinson's own work is heavy and coarse, whereas the drawing and handprinting of William Bird is excellent.

One of Robinson's sheets[10] shews the "Ruins of Panjahung Coorchy", about 20 miles west of "Putnun Mardoor" (on the sea), with sites about two miles west of "Monuments of the Officers of 74th Regt.—Moormen's Monuments"—Lieut. Collins' and Blake's Monument"[11].

Joined by Chamarett and Aikin from Turnbull's party in Pudukkottai, Robinson surveyed the south-west part of Rāmnād *zamīndāri*[12], and in September 1814 completed the islands along the Rāmnād and Tinnivelly coasts as far as Tuticorin [140].

Markham's tale that the Tinnevelly surveyors shirked the hilly area on account of its reputed unhealthiness[13] is not confirmed by contemporary records. The forest-clad Ghāts were only of interest to District Officers so far as the roads and passes through them were concerned, and we have seen above that Robinson had surveyed these. The Revenue Surveyors, unlike the officers at the Military

[1] Letter of 25–1–10 ; M Rev Bd. 12–4–10. [2] Also Wm. Bird, later. [3] *Triangles in the Province of Tinnivelly* ; MRIO. M 11. [4] M Rev Bd. 12–4–10. [5] to Morison, 18–5–11. [6] Maps, MRIO. 147 (25) ; MRO. Maps 338, 339, 344, 353, 358. [7] MRIO. M 567, 18–9–13. [8] ib. 21–10–13. [9] MRIO. Misc. 7–0–13 & 2–PT–13. [10] of 2–PT–13. [11] Edward Henry Collins & John Blake both Mad. Inf. ; kd. 5–9–1799, in attack on Punjalamcoochy. [12] Fdbks., MRIO. M 83, 567 ; Maps, MRIO. 136 (36 *et seq*) & MRO. Map 156 ; MRIO. 136 (44–6) shew Rameswaram I. [13] Markham (76).

Institution, received no instruction whatever in the survey of hills, and Montgomerie writes of Robinson's map in 1826 ;

The Hills resemble a Sea of Ink. ... The detail of the Flat Country in general appears to be faithfully delineated, but the Surveyors appear to have had no idea of expressing the Hillyor Mountainous parts of the Country. The only written records delivered with the Plans of this Survey were a few rough Field Books, but from which a Register of 1600 Triangles was made out[1].

Robinson's own account is that

The Intersected Points of every part were carefully laid down, and the unknown sides and angles of each triangle calculated, and protracted on separate sheets of Paper to serve as sections for the guidance of the Assistants in filling in the detailed work, and as Mr. Thos. Hill...had subsequently been removed to the Presidency, the completion of the Map...was, I understand, drawn up by him in the Surveyor General's Office[2].

Thomas Turnbull's statistical report on Tinnevelly was carried out in 1820–2, several years after Robinson's survey.

TANJORE, 1805–10

In October 1799 a treaty had been effected with the Rāja of Tanjore, under which the Company assumed entire control of his State, and five years later the Collector asked for a survey ;

In a Country like Tanjor, watered and intersected on every side by numerous natural and artificial channels, a correct scientific survey of the rise, course, and level of each of these channels is almost indispensable to the satisfactory management of Revenue Duty. ...

Independent of a regular survey of the Rivers and channels giving fertility to Tanjore, I have the opinion of Captain Caldwell, as well as my own observations, for stating...that...the Surveyors will be *particularly* useful in ascertaining scientifically several points on which will depend the...remedying...several defects in the present mode of supplying some very important districts with water, from the deficiency of which a great loss of Revenue has been sustained of late years.

The Board will also see the propriety of sending Surveyors into Tanjore, when I state that there is not any Map of this valuable Province ; from the compact situation of Tanjore, the Surveyors will be able to furnish one within a period comparatively short[3].

In January 1805, therefore, Turnbull was moved from Madura, and joined in Tanjore by James Aikin[4], whilst Christian Pereira was sent out from the school to assist Johnson in Madura[5] [140].

In 1810 the Collector explained that the slow progress in Tanjore had been due to the peculiar difficulties which the Tanjore Country presents to a minute survey, in its almost universal intersection by rivers and large watercourses ; its being under water a considerable portion of each year, and the great number of villages it contains. ... A considerable portion of the Surveyors' time has *until lately* been occupied in laying down Plans and copying Field Books to accompany the Quarterly Reports, and that their being so occupied *materially* interfered with the Progress of the Survey.

Notwithstanding these difficulties, more than ¾ of the country has been minutely, and I hope accurately, surveyed, and the remaining part will be finished before the next floods in July. All the villages, rivers, watercourses, tanks, roads, and limits, have been laid down, and the survey when completed, will I think, form a very satisfactory record of the Province[6].

Turnbull seems to have been more than an excellent surveyor, for the Collector commends him and Aikin "as well for their uniformly peaceable and sober conduct as for their diligence and attention to their business[7]", whilst Montgomerie writes in 1824 ;

The Tanjore Collectorate was surveyed between the years 1805 and 1810 by the Revenue Surveyors under the Collector[8]. It appears to have been faithfully executed, and in as far as Topography was at that time attended to, the features of that part of the Country are well expressed. The Rivers and their branches are laid down with great minuteness ; had the cultivation been also expressed, it would have added to the value of this Document[9] [151].

[1] DDn. 246 (42, 45) & 222 (140), 9–6–27. [2] DDn. 218 (60), 10–10–25. [3] M Rev Bd. 22–11–04. [4] and later by Chamarett and Mackay. [5] ib. 17–12–07. [6] ib. 12–4–10. [7] ib. 30–4–11. [8] Map, in 12 sheets, one-inch scale ; IO. Maps II AC. (34) ; also MRO. Map 311, 2000 yds. to 1 inch, 2 sections ; shows triangles and a wealth of detail. [9] MRC. 26–10–24.

PUDUKKOTTAI, 1813

Tondiman, Rāja of Pudukkottai, had always been a loyal ally to the Company, but it was not until 1811 that the Resident at Tanjore asked for a survey of his country ;

I suffer much inconvenience from the want of a map of Tondiman's Country, and beg leave to solicit...permission to Major Lambton to furnish me with a series of his Triangles embracing the whole of Tondiman's Country and a portion of the adjoining provinces.

If these Triangles are given upon a tolerably large scale, it will be easy for me to have them filled up by the Surveyors attached to the Collectors[1].

No surveyors were available till 1813 when Morison suggested

the expediency of a surveying Tondiman's Country in connexion with Ramnad, Shevagunga, Tanjore, and Trichinopoly. In the progress of these surveys the greater part of the boundary of Tondiman's districts has already been determined and, as the triangles established by Major Lambton on the Trigonometrical survey embrace the tract in question, the details of this work may be commenced without any delay, and with much advantage, by the Surveyors now at my disposal[2].

to which the Resident replied that

the proposition has been received by the young Chief with the greatest pleasure and thankfulness, under the hope that the Honourable the Governor in Council will have the goodness to comply with his request for a copy of the survey to assist him in the improvement of the cultivation of the country[3].

Turnbull's party accordingly took up the survey in addition to their work in Rāmnād, and completed it between June and November 1813, with the help of Keyes and McMahon from Coimbatore [148][4].

TRICHINOPOLY, 1803–10

According to Montgomerie ;

The Trichinopoly Collectorate was surveyed between the years 1803 and 1810 by the Revenue Surveyors under the Collector. It depends on Triangles carried on from the Surveyors' measured bases, and subsequently corrected in a reduction by Colonel Lambton's Points.

Several parts of this survey have a very unsatisfactory appearance, and, from the character of J. Faulkner as a Surveyor, one of the two employed on that duty, I fear that much reliance cannot be placed on the work that may have been executed by him[5].

Of one of the maps surveyed by Faulkner and Pope [142] in 1808, Warren writes that it "wants a series of triangles to render it complete ; as it is, it can nevertheless be very useful to the Collector". On the other hand Montgomerie writes again in 1826 ;

This Survey bears every appearance of having been executed in a very loose style, together with complaints of great inaccuracy by the Collector of the District, and want of authentic material of construction[6].

There is now at Madras a

General Plan of the Trichinopoly District from surveys by Silvester Pope and John Faulkner ; scale 3,000 yards to an inch ; signed by De Havilland, Inspector of Tank Repairs, June 25th 1818. Size 65 inches by 36[7].

COIMBATORE & NĪLGIRI HILLS, 1806–13

The survey of Coimbatore District was in hand some time before 1807 and, writes Warren ;

Mr. Garrow...gives a satisfactory account of the services of Samuel Godfrey, who has been lately engaged in surveying the very unhealthy and mountainous Districts of Collagal[8] and Sattigal. He is now extending his operations in the low lands of Coimbatore. ... Godfrey

[1] DDn. 127 (113), 26–11–11. [2] MPC. 23–4–13. [3] ib. 7–5–13. [4] Memoir, MRIO. M 87 ; Maps, MRIO. V (291) & MRO. Map 420 ; Correspondence, MRIO. M 567, 1–9–13 to 2–11–13. [5] MRC. 26–10–24. [6] DDn. 246 (63). [7] MRO. Map 411. [8] 57 H/4.

very properly grounds his Survey on the points and distances furnished him by Major Lambton. ... His perseverance in the Survey under repeated attacks of the hill fever is highly creditable to his zeal and industry[1].

He was joined by Keyes in May 1807[2], and a year later Warren reports that Godfrey has forwarded a survey of the Collagal Talook in the Northern Division of Coimbatore, supported by a series of Triangles, which does credit to this young man's assiduity. His progress has been impeded by indisposition, as well as that of Keyes, his Sub-Assistant, caught in the jungle among the...Ghauts[3].

About 1809 Godfrey was relieved by McMahon, and in August 1811 the Collector reported ;

The greater part of the low lands having been finished, I should think the remainder should not take up above six months more. The extensive range of Ghauts that border on Malabar, Wyenaud, called the Neelgherry or Blue Mountains, will require, without obstructions intervening, a period of at least six months more, but from the inhospitable climate of these Hills I have no hesitation in saying that the Surveyors will meet with continual interruptions from attacks of fever in themselves and followers[4].

In January 1812 Keyes reported that they had continued

Survey in the low lands on the N. of Coimbatoor only to the 15th of October last, after which, in consequence of the unfavourableness of the weather and indisposition, with the orders of the Collector we retired into Bhovany[5], where after completing the fair Plans of the Survey the reduced Plan of the whole was taken in hand[6].

There is at present remaining but 200 Square Miles of the low country to be surveyed, together with the lands on the extensive range of the Neelaghery Mountains[7].

and again in May ;

During the last month I finished the Survey of the Neelagherry Mountains lying on the Westward of Danaikencota[8], and extending in length from E. to W. about 30 miles and breadth 16 miles, thereby making a superficial extent of 480 Square Miles ; as also the elevated tract of Country about Davaroyputnum lying on the northward of the Mountains, containing 110 square miles.

I shall next extend my Surveys to the Southward upon the remaining part of the low Country[9].

Keyes and McMahon were the first surveyors to enter the Nīlgiri Hills, and it is not surprising that their training at the observatory had not qualified them to make much of a success of the hill features[10]. Their work during 1812 and 1813 included a "Plan of the Neelgherry mountains in the Denaikencota taluk, and part of the Sattimungalum and Coimbatore taluks[11]". The main rivers and streams are sketched in, and the hill forms roughly shown by pencil hachures and colourwash. Though the hills were obviously visited, the original map gives no indication of triangulation or systematic survey.

The surveyors closed work about July 1813, and then joined Turnbull for the survey of Pudukkottai in September [147].

In his published account of Ootacamund[12], Price describes this early visit to the hills after first noticing that Francis Buchanan [113], on October 24th 1800, was at "Davanaicota", and walked up into the hills, and got a distant view of the highest hills, and probably reached Arakod[13]. He then quotes Mackenzie's account of the survey of Keyes and McMahon, submitted with

a map of the Neelgerry mountains in the District of Danaikencotta in the Coimbatoor Province on the original scale of survey of one mile to an inch.

I have selected this as an original specimen of the work of the Native Assistant Surveyors, and of the survey of a singular tract of mountainous country, situated centrally on the limits between the countries of Malabar, Mysore, and Coimbatoor, remarkable for their singular Tribes of people, described to be dissimilar to the natives of the other Provinces in habits, manners, language, and complexion ; some notices of whom are communicated in the Memoirs of the Mysore Survey sent home in 1808. ... This tract contains 495 miles of mountains and 250 of plain country, altogether 745 miles[14].

[1] M Rev Bd. 8–1–07. [2] ib. 21–12–07. [3] Triangles by Godfrey & Keyes, 1807–12. MRIO. M 20, 22. M Rev Bd. 24–4–08. [4] DDn. 127, 27–8–11. [5] Bhavāni, 58 E/11. [6] Fdbks. & Memoirs, MRIO. M 20, 23. [7] DDn. 127 (160), 1–1–12. [8] Danāyakkankottai, 58 E/3. [9] DDn. 127 (256), 7–5–12. [10] MRO. Map 73 ; MRIO. 133 (210). [11] MRO. Map 76. [12] Price; cf. Francis (226) & Grigg (25 *et passim*). [13] cf. *Imp Gaz. Mad.* II (299). [14] MPC. 434/1816, 18–1–16.

Price was misled by the expression "Native Assistant Surveyors" [I, 283 n.8] into thinking that Mackenzie referred to some earlier party of Indian surveyors, and suggests that, being Indians, they would have been afraid of ascending the mountains, and that, "with no European to look after them", their map must have been "a fancy one based on hearsay". He says that "Mr. Sullivan, then Collector of Coimbatore, wrote in 1819 that they "were frightened by the extreme inclemency of the climate, and did not measure an acre". This again is misleading; the surveyors were not expected to "measure" hills, more particularly because these were, from the district officers view, entirely unproductive; furthermore there is ample evidence that most of these assistants carried on work bravely in spite of fever and sickness.

Price continues with some interesting facts;

In 1812, a surveyor named Keys, accompanied by McMahon, an apprentice, was set up to the Hills by Mr. Garrow, the Collector of Coimbatore, to make a plan of them. He started from Devanaikencotah and evidently travelled by the path used by the garrison of Malekota for communication with their base in the plains. His first letter was written on 30th March from "Tenad", no doubt Daynaud of later explorers[1], east of Kotagiri, ... and reached a point about six miles from Ootacamund.

McMahon was back at his starting point on the last day of April 1812. ... The report on his expedition which is given as Appendix No. 17 in Grigg's Manual does not create the impression that it is the result of much personal examination. It is doubtful if Mr. Keys set eyes on the Ootacamund plateau, and he probably kept to the Lower Plateau.

NELLORE & OTHER DISTRICTS

In 1804 Goldingham submitted to Government a

Revenue map of Nellore and Ongole[2], laid down by computed Distances, and according to the internal Division of Pargannas, from correct information obtained under the inspection of J. B. Travers, Collector[3].

The map was "executed with care" on the scale of 6 miles to an inch, and nothing further is known about the materials used.

During 1810 regular surveys were in progress under the tank department;

Three Assistants are at present employed under the Superintendent of Tank Repairs [139], and two others lately under the same controul have been employed on the survey of the Nellore District. The latter are...stated to be employed on a survey of the Eastern Ghauts, but it appears that they are still at Nellore. I have understood that they have nearly finished the survey of that district, in which case they should close that work before their removal to be employed on any other[4].

Shortly after, Charles Johnston, Superintendent of Tank Repairs[5], reports that,

in consequence of the removal of the young men attached to my Department (James Allan to the Observatory, and Joseph Jelly and William Mead to the Quarter Master General's Department, which was effected during my absence on the late Foreign Service), I was concerned to find upon my return to the Coast that the Nellore and Ongole surveys had been materially impeded[6].

A compiled map on the scale of 4000 yards to an inch, entitled "A Topographical survey of the districts of Nellore and Ongole, reduced from the original[7]", bears Johnston's signature.

In 1813, districts belonging to the Rāja of Venkatagiri[8] were taken up by surveyors from the Ceded Districts [155], who also in 1814 surveyed the *jāgīrs* of Udayagiri and Pāmūru[9].

The greater part of South Arcot was surveyed by students of the Military Institution [125–9], but there is at Dehra Dūn an original undated survey of country south

[1] Denād, 58 A/15, 8 m. E. of Kotagiri. [2] 66 A/3. [3] MRO. Map 238. MRC. 6–12–04 (5). [4] Governor's Minute of 31–12–10; MMC. 29–1–11. [5] Charles Cornwallis Johnston (1786–1817) son of Richard J— and Jean-Baptiste Maillard; b. Madras; Ens. Mad. Inf. c. 1802; d. Hyderābād 14–10–17. Probably acting for Caldwell who resumed charge in 1813 [I, 321]. [6] M Rev Bd. 8–4–11. [7] MRO. Map 241. [8] 57 O/9. [9] 57 N/5, M/8. DDn. 246 (106).

and east of Tricalore "done with the Planetable by William Mead, Sub-Assistant Surveyor"[1], and in 1808 Henry Lincoln, was working under

the Collector of South Arcot for the purpose of making surveys of certain Indigo manufactories [15], & running levels thro' the course of several channels of supply, preparatory to their inspection by the Superintendent of Tank Repairs and Water courses[2].

A large part of Malabar had been surveyed by officers of the Bombay establishment [I, 131–2], but not in sufficient detail for the purposes of civil administration, and in 1802, after the transfer of the province to Madras[3] [165], the Revenue Board forwarded to Government

a letter from Major Macleod[4], stating that, as many parts of the province of Malabar have not been surveyed, he has employed a Surveyor and draftsman on a monthly pay of one hundred and fifty (150) rupees; that he has lately formed a new map from several others constructed by Engineers, and is now engaged in copying one of Mahé[5] and its environs, to explain the encroachments said to have been made by the French.

Major Macleod has expressed an hope that the employment of this Surveyor will be approved, and has recommended that half a pagoda per day in addition be allowed whenever he may be employed on actual survey. Desirous of obtaining every information of this province, as yet so little known, we recommend the Collector's proposal, ... and that two Assistant Surveyors be sent from the school to Malabar, to assist the work.

This was duly approved, and it was ordered that

Silvester Pope and William Webb [I, 286], who are reported qualified, may be equipped with instruments proper for surveying, furnished with clothing, and be directed to proceed with all practicable despatch to Malabar[6].

In 1804 the Principal Collector wrote from Palghāt, submitting a report from C. Hemphel, surveyor-draftsman, on all the work he had done since his engagement in November 1801[7]. This included a fair chart of Malabar on the ¼-inch scale, and large scale surveys of Tellicherry and Mahé. The Collector further asked that he might keep on

the two surveying boys, who will be most useful under the Gentlemen who are in the management of the interior districts; but so far the disturbed state of the country has impeded their surveys[8].

This was not approved, and Webb and Pope were moved elsewhere.

GENERAL MAPS

The preparation of general maps for the Board of Revenue, the Government, and the Directors, was first the responsibility of the Inspector of Revenue Surveys, and then passed to the Surveyor General who, in 1812, submitted to Government

a Map of the Districts of Tanjore, Trichinopoly, Coimbatore and Madura, together with the Polliams of Nuttam and Manapara[9], protracted on a scale of four English miles to an inch, ... a compilation of certain detailed surveys which have been carried on...for several years by the Assistant Surveyors of the late Revenue Establishment. ...

Although a considerable proportion of the surveys...were completed, previously to the extension of the Trigonometrical Survey under the direction of Major Lambton, ... yet a considerable part...have been prosecuted latterly, having the triangles of Major Lambton as their foundation. In constructing therefore the map of the districts, ... the first object was to lay down all the principal points which had been determined by the Trigonometrical Survey. ... The detailed surveys...have been verified and corrected, ... and...inserted in the map. ...

The surveys of the Shevaganga Zemindari and Tinnivelly are now in great progress [140–5], and I trust that in the course of the ensuing year it will be practicable to complete these, and perhaps the District of Ramnad and Tondiman's country, ... when the Government will be in possession of a detailed survey...from Cape Comorin to the Southern Boundaries of Mysoor, the Baramahl, and the Province of Arcot, completed by the Surveyors of the late Revenue Establishment. ...

[1] Tirrukkoyilur, 58 M/1; MRIO. 6-PT.-19. [2] M Rev Bd. 2–5–08. [3] from July 1800, Logan (531). [4] Wm. Macleod, Mad. Inf. from Collr. Salem, to be Principal Collr. Malabar, 1801; furl. 1804; Cuddalore, 1809. [5] 49 M/10. [6] MRC. 4–6–02. [7] Hemphel had drawn map of Malabar for Sartorius, May 1793 [I, 131]; MRIO. 146 (37). [8] M Rev Bd. 2–2–04. [9] Rāmnād.

I cannot...conclude without expressing the satisfaction which I have derived from the manner in which the Survey of Tanjore, in particular, has been executed [146]. The original map...is extremely minute in every respect. I have, accordingly, in the compilation now submitted, been careful to include in the minutest manner all the water-courses, and all the information which it has been practicable to exhibit on the scale. ...

The survey of North Coimbatoor, including the Neelgherry mountains, ... has been also carried on the most satisfactory manner ; but the surveys of Coimbatore south of Noel River[1], and of Madura and the Polliams, are altogether inferior to the surveys of Tanjore and the Northern Division of the Coimbatoor country [147–8]; ... The whole has, however, been corrected by the application of the Trigonometrical operations. ...

The plan of Dindigul [139–40]...has never been in the possession of the Surveyor General, and...although I have made every enquiry towards its discovery, I have not been able to obtain either the original, or a copy of it, which will also explain the cause of Dindigul not having been inserted in the compilation. ...

I regret that the original plan of Madura and Manapara now forwarded are not in the best state of preservation. They seemed to have been much used before they were received into this Office[2].

Most of the original field sections of these district surveys shew not only the sides of Lambton's triangles, but also the minor triangles laid down by the surveyors. It is possible that this minor triangulation was plotted graphically and never computed ; some of it was certainly laid down by planetable. The *Bengal Register of Maps* records the existence of " Plans of Triangles for several districts[3].

In 1814 Morison reported

the completion of the Survey of Tinnivelly, Tondiman's Country, and Shevagunga ; and I have now the satisfaction of adding that the district of Ramnad, together with the Island of Rameswaram, has also been completed in the most satisfactory manner [145]. The plans are now under discussion, and a map of the whole will be ready at an early period. ...

The surveyors have been ordered to be employed in the Dindigul District, which when completed will be included in the map under preparation ; when the Honourable Court will be placed in possession of actual surveys of the whole of the countries from the Cavery to Cape Comorin, East of the Ghauts.

I have already reported that the plan of Dindigul has been lost, and, considering that the survey of that District was of a very imperfect nature compared with those which have been more recently executed, ... it has appeared to me to be highly desirable to have the work done again before the surveyors should be withdrawn from that part of the country[4] [140].

The final map was submitted in January 1816[5].

[1]Noyil R., 58 B/13 to E/16. [2]MPC. 17–10–12. [3]*Ben Regr.* 586 (15–20). [4]MPC. 9–12–14. [5]ib. 18–1–16.

CHAPTER XI

OTHER MADRAS SURVEYS

Ceded Districts, 1809–13 — Goa, 1810–13 — Sonda, or North Kanara, 1813–5 — Northern Circārs — Mackenzie's Review, 1810 — Establishment, 1811.

ON completion of the Mysore survey, Mackenzie kept his assistants in Madras to work up the maps and memoirs, which he submitted in October 1808 [111–2].

Occasional field work was found for the surveyors—Ward ran a series of triangles from the eastern border of Mysore, through Vellore and Conjeeveram[1], to Fort St. George, thus making a connection between the Mysore survey and the observatory independent of Lambton[2]—Hamilton and Lantwar made a survey of Conjeeveram—Summers surveyed the road from Madras to Pulicat—and Lantwar made various small surveys in Madras[3].

Mackenzie had for some years cherished the wish to extend the Mysore survey northwards through the Ceded Districts up to the boundaries of the Nizām's dominions.

Under a treaty signed at Hyderābād, 12th October 1800, the Nizām had ceded to the Company the territories acquired from Mysore in 1792 and 1799 [I, 119] in order to provide for the maintenance of the subsidiary force. These ceded districts, covering Bellary, Kurnool, Anantapur, and Cuddapah[4], were at that time in a very disturbed state and General Campbell [98] commanding the forces of occupation begged for a map, but Mackenzie was fully engaged on the northern boundary of Mysore;

> Unless something very pressing demands it, I should suppose that the part I am now employed on had better be first finished. ...
>
> Your ideas of my being employed for some time at least in the Ceded Districts would not at all disagree with my wishes, if it can be arranged without detriment to my present employment, and with the goodwill of Government and all concerned; and, though I am ambitious of completing anything I enter on, ... it might not be found difficult to reconcile, but it does not depend on me[5].

He was not able to leave Mysore, and the Ceded Districts were left unsurveyed, except for Munro's detailed revenue survey [180–2]. In December 1807 Munro's successor wrote to the Board of Revenue;

> As...there is no accurate map of the Ceded Districts, and the late Division of them into three separate Collectorships, without their respective boundaries are correctly ascertained, being likely hereafter to be attended with some inconvenience, I...submit to the Board the utility of employing three or four boys from the Surveying School for this purpose[6].

On this, Mackenzie

> suggested that four of the six Sub-Assistants on the Mysore Survey may be employed to advantage extending a survey into the Ceded Districts. ... I communicated last year to Colonel Munro...specimens of 2 districts surveyed [in Mysore], and he was of opinion the same mode might be usefully applied throughout. ... The instruments purchased on the Mysore survey are still fit for service, and the extension now...may some time hence save more expensive works[7].

After inspecting the maps and memoirs of the Kanara survey [108–12], the

[1] 57 P/9. [2] MRO. Chart 279; DDn. 43 (257), 26–10–08. [3] Fdbks. MRIO. M 50, 61, 117. [4] Bounded on the S. by Mysore—on the NW. by the Tungabhadra—on the N. by the Kistna [pl. 11]; Maps, 6 in. to degree, shewing schedule of revenues, sd. by Thos. Sydenham, Sec. to Resdt. Hyderābād; MRIO. Misc. 4–0–1801. [5] DDn. 66, 19–12–00. [6] M Rev Bd. 4–1–08. [7] MPC. 16–8–08.

Revenue Board agreed "that it is highly desirable that survey of Ceded Districts should follow the same principles as the surveys of Mysore and Kanara"[1].

Dunigan and Ward were therefore sent up to the western districts early in 1809, two years before Lambton ;

You are to proceed with all possible expedition, with the two Sub Assistants James Summers & William Howell...into the Districts Ceded by the Nizam in 1800, to Survey them in connexion with the Survey on which you have been already employed in Mysore, & in the Western & Eastern Districts ceded to the Company in 1799 [91–2]. ...

To enable you to execute your work with greater accuracy...you are to take an early opportunity of selecting a convenient place for measuring a Base Line to serve as the Fundamental Basis for extending the Principal Stations thro' that Country further to the North & East, & to verify & connect with the Stations of the former Survey. ...

The Maps of the Survey to be laid down on a Scale of 2 Miles to an Inch[2]. On all occasions you should comply with any Requisitions of the Collector, acquainting me of the same[3].

Leaving Madras on March 17th, the surveyors reached Hindupur[4] on 3rd April and measured a base near Wajrakarūr[5], each detachment then extending triangulation over the districts allotted to it. Ward and Summers surveyed "Bellary & Kumply, including the valley of Sundoor—Adwanny—Kurnool", whilst Dunigan and Howell took up "Gootydroog, Nudjar Carroor, ... Raidroog, Cullian Droog. Protractions were laid down on the ½-inch scale[6].

The following extracts from Mackenzie's letters to Ward include references to his collection of historical inscriptions [156] ;

May 27th. ... Narain Row should avail himself of the opportunity to obtain every kind of Inscription & History, as he belongs to that Department, tho' I wished him to be near you as long as he can be useful. When he has got everything in your vicinity, you should concert with him & get such sanction as may be necessary for any part of the District.

I hope the Collector has sent proper people to attend you. ... Each of your parties will require an intelligent person.

Aug. 18th. ... As the time & vicinity is now favourable for sending Narrain Row to Godaval, I enclose him a letter for the Chief of that Place, with whose father I used to correspond a few years ago. ... This will enable him to obtain some useful Accounts & Histories there, but tell him not to stay long, as I shall want him to go to other places bye & bye.

Sept. 6th. ... I approve of your going on towards Ballary, as by that means you will complete the country in that direction. I am glad you mean to take a Plan of Adoni ; let it be minute & every remarkable Place inserted, as it was never taken before, so far as I know. I wish you would take some Sketch view of it.

Nov. 4th. ... I have duly received your letter of 19th September mentioning your proceeding on the Survey of the Ballary Talook after completing that of Adoni, which is very satisfactory. ... You will of course include the Soondoor District with that of Ballary, distinguishing the Limit so far as the rugged nature of the Country will admit [97] ; but as the District, I believe, belongs to a Maratta Family, you will previously apply for the sanction of the Collector. ...

5th. ... The Sketch you sent of Adoni was very acceptable to me ; I have no doubt but you can do very well in that way.

In your Survey down by Comply you will come of course upon the Ancient ruined City of Beejanagur [I, pl. 9, *Bisnagar*]. ... Be particular in noticing anything remarkable that occurs there, for though I have been there already & have a Plan of the Ancient City, it is possible you may meet with things that escaped my notice, as we were sickly there [98].

Tell Narrain Row to be vigilant in getting every possible Historical Notices about Complee &c. ... Make my Compliments to the Old Anagoondy Man if you see him there.

Dec. 5th. ... I will be anxious to hear of your being done with that hilly country west of Complee, and when you have got through it, you should lay down your work in some open country such as Ballary.

Jan. 1st 1810. ... From...your reports of the completion of the Ballary & Soondoor Districts I derive much satisfaction. ... Should your health be so far re-established as to render it advisable, I entirely approve of your proceeding on the Survey of the Districts to the Eastward

[1] M Rev Bd. 3–4–09. [2] but actually completed on 1 inch scale [155] ; DDn. 83, 15–3–09. [3] ib. 7–6–09. [4] 57 G/5. [5] 57 E/8. [6] MRO. Map 28, Province of Harpunhully, 1809–10, M. Dunigan ; Ward's Journal, MRIO. M 138 ; DDn. 246 (104).

of Adoni. ... As I believe Canoul & Baganpilly are under the immediate management of their own Mahomedan Chiefs of respectable Family & Rank, who may not be so well acquainted with the Objects of these Surveys, I am particularly anxious that you should take every opportunity of rendering the Survey in these Districts as little obnoxious to them as possible. ... In requiring the Lists of Villages, therefore, & Boundaries, you will be as tender as possible, & regulate yourself in any difficulty by the directions & advice of the Collector, who I hope will order his Vakeels to assist you.

July 10th. ... Your letter of 14th came in reporting the completion of the Survey of Canoul. ... The situation of any mines of Iron, Salt, or other minerals, should be marked and indicated by a star or any other mark, and in your memoirs should be referred to. ...

Meantime you can prepare yourself for your journey, as I have no doubt of being able to obtain the necessary sanction for your coming to the Presidency[1].

Ward was now given a commission in the Madras Infantry, and went down to the Presidency in August 1810; after finishing off his maps[2] and reports, he left on October 10th to join his corps at Wālājābād.

In January 1810 a third pair of surveyors, Hamilton and Lantwar[3], had been sent up;

Jan. 29th. ... As a Line has been already measured at Ballapoor [99], which will serve as the Base of the triangles carried into Gurramconda[4], it is not necessary for you to measure one at this time; especially as your Triangles will afterwards come in connection & be confirmed or corrected by those extended from the Bases measured last year near Raidroog[5]. Taking the sides of one of the most convenient of the Southerly stations as your Base, you will carry on from thence your series of Triangles & of secondary stations; & the details of the Country...may be then laid down agreeable to former Instructions and Practice[6].

Mackenzie writes later to Hamilton;

May 12th. ... I approve of your intention...to go on to complete the Plan Work, so that you and Lantwar...make up whatever belongs to that District before you engage in another. A Plan of the Triangles with your Computations should accompany that of the Country you have surveyed. ...

and to Lantwar;

I wish you to attend particularly to notice the Rivers, their sources and courses, and junction with others; the Ridges of Mountains, their Productions; the Tanks and Canals &c., and that you write the names very accurately, attending closely to the true Orthography as pronounced & spoke by the Natives[7] [271].

Oct. 2nd [to Hamilton]. ... As soon as you have completed the Field Work, I wish you & Lantwar to meet...as most convenient & central, ... where you may finish your Plans and Memoirs, &...derive the advantage of comparing & computing your Triangles.

Exclusive of your Separate Plans, all Triangles of both should then be laid down on one Plan on a scale of 4 miles to an Inch; it is my intention that these Triangles should be afterwards extended North to some place near Kurpa, where a Base may be...measured to correct them.

Your stations on the West & also the Boundary, you should also communicate to Mr. Dunigan, who is directed to Survey the Tadmerry...Districts till they join yours, ... by which means all your works may be afterwards united more conveniently together.

He wrote to Dunigan;

I was pleased to see the gradual progress of the Survey of Harponelly &c. ... I imagine from your last that you have completed now the whole of the Country lying between the Mysore limits of Hurryhur, ... surveyed in 1800 & 1801 [95] & the Districts of Ballary, Raidroog &c., surveyed lately by Ward & yourself[8].

The perusal of these papers...gave me considerable satisfaction, as they appear to be laid down very distinctly, and I doubt not but that the calculations of the triangles on which the whole is formed will be found correct[9].

After Ward's departure Summers was directed to join Dunigan on the Survey of Anantapoor & Darmaveram, but as it is probable that he may be on the way coming up, I have directed Hamilton to communicate to you his Western Primary Stations, that you may save time by beginning as early as possible on the nearest parts till Dunigan comes into the District[10].

[1] Letters to Ward, DDn.83 (*passim*). [2] MRO. Map 27, Province of Adwanny. 1809; scale 2 m. to an inch. MRIO. 135 (25, country S. of Tungabhadra R. and Kurnool. 1810. [3] Relieved by Ficker 12 months later [156 n.2, 163]. [4] 57 K/9, pl. 11. [5] Rāyadrug, 57 B/14. [6] DDn. 83 (49), 29–1–10. [7] ib. (61). [8] MRO. Map 25, *The Collectorate of Bellary*, 4 m. to an inch; DDn. 83, 16–7–10. [9] DDn. 83, 30–9–10. [10] ib. 13–10–10.

To Dunigan Mackenzie wrote, acknowledging
the Memoirs of the Koodelghee & Harponelly Districts, the Computations of Triangles & Journal of the Weather. ...

As the Survey of Durmaveram, Anantapoor &c. will terminate the Western Division of the Ceded Districts, I could wish you to proceed with all possible dispatch in Order to conclude that Part, & trust the late addition to your Party by James Summers...will tend to accelerate this object, & that he will make up by redoubled attention for the time he has lost. I should be extremely pleased if the whole Western Districts could be completed by the end of the year[1].

In September 1811 Dunigan and Hamilton measured a second base near Cuddapah, and survey was extended to the mountainous borders of the Carnatic. Dunigan reported in November that he would have made better progress
had not the setting in of the Rains which poured incessantly for several days together retarded... the Field duty. Notwithstanding the then uncertain state of the Weather, I still continued to take advantage of every fair interval in compleating that Portion of the Survey I allotted for myself...which was finished about the middle of August.

About this time the Weather clearing up for a short interval, I was anxious to avail myself of that opportunity of visiting some of the Principal Stations on the Nulla Mulla mountains[2] in order to connect my Triangles with Mr. Ward's Stations of Kurnool, and which I followed up (with the Survey of the Roads) by an Excursion across the Country, visiting the other Primary Stations made use of in the Surveys...allotted to Assistants Summers and Wm. Howell, who by this time had entirely compleated their respective shares of the Work, and joined Mr. Hamilton. ...

Since my arrival in this quarter I was engaged for some time in looking out for a suitable spot of Ground for measuring a Base, and have happily succeeded in determining upon a fine level plane [*sic*]...in the Neighbourhood of Cuddapa[3].

He completed this base by December, and then worked eastward towards Cumbum[4], when the Surveyor General directed him
to connect the Survey of the Ceded Districts with that of Ongole and Nellore [149–50]. ... In connecting these Surveys I request that the boundary which divides them may be surveyed correctly, filling up at the same time all unsurveyed spaces in the tract between the Ceded Districts and the Company's Country, and taking great care to give no offence to any of the people of Calastry and Vencatagherry[5].

Dunigan reported in November that this junction was completed, as well as "all the scattered portions of territory of the Venkatygherry Rajah" [149][6]. In February 1814 he sent in his maps and papers with Howell and the *gomashta* Anand Rao[7], whilst he stayed on to finish off various pockets along the Mysore border. The last surveyor reached Madras in May 1815.

In January 1816 Mackenzie submitted
a general Map of the whole of the countries ceded to this Government on the partition of Mysore by the Treaty of Seringapatam of June 1799, and from the Nizam afterwards by the Treaty of Hyderabad of the 12th October 1800, carefully reduced to a scale of 4 miles to an inch[8]. ...

The Map...includes the space of 28,989 sq. miles, surveyed on the same plan and system as that of Mysore, including the exterior limits of the Frontier and the interior limits of each Purgunnah of the Cessions ; the Great Features of the Country, the mountainous ridges, the Rivers, Forts, Woods, Roads ; and nearly, ... every village of each Purgunnah, ascertained by survey from the Official Registers of the Districts.

The original sections and plans of Districts deposited in Office exhibit the same on a scale of one inch [153 n.2].

The two accompanying volumes contain merely the statistical Tables of Population, and the Registered Lists of villages laid down by their positions from the Great, or secondary, stations[9]. This method, which I believe has not hitherto been employed, except in the surveys of Mysore and of Baramahl, ... has the peculiar advantage of preserving an authentic Record of every individual village ; ... Whilst it affords considerable advantage in all future disputes of limits, it is attended with no additional trouble in the survey [213]. ...

[1] DDn. 83 14–11–10. [2] Nalamala Range, Eastern Ghāts ; 57 I/NE. to J/NE. [3] DDn. 127 (99), 1–11–11. [4] 57 M/2. [5] DDn. 83, 1–8–13. [6] DDn. 136, 16–11–13. Venkatagiri, 57 O/9. [7] MRIO. M 567, *Memoir, Oodaghery & Venkatagherry*, MRIO. M 83. [8] Maps, with plan of triangles, MRIO. 132 (13); 2–2–14; 133 (27); 134 (16) ; 146 (11, 23, 24) & Ben. Regr. 585 (14). [9] Village Registers, MRIO. M 17, 51.

Exclusive of these Registers, the usual remarks on the face of the Country ; on productions, soil, climate, &c., have been collected, which...I propose to arrange in the form of Memoirs Descriptive of each District[1], together with a brief abstract of the History of each Province. A considerable body of the latter species of materials has been obtained, but, as the whole were written originally in the Native languages by persons trained and employed for this purpose, it has been found impracticable to get the whole of them yet translated or properly arranged. ... It is my intention to reserve this for a period of more leisure than can be obtained under the present complicated avocations of this Office [93, 278, 304]. ...

The Survey has been entirely executed by from 4 to 6 Native Assistants[2], reared originally on the foundation of the late Revenue Surveying School, but trained to the Field, either by the late Mr. Mather or by myself, on the survey of Mysore [101, 106, 110]. ... To these were occasionally added other young men reared by me[3], who were necessarily withdrawn on the establishment of this Office[4] [303, 352].

GOA

In August 1810 orders were issued for the transfer of Garling and 7 other officers of the Military Institution[5] from the east coast [2, 127] to survey the Portuguese territories of Goa. Two civilian sub-assistant surveyors completed the party[6]. Since the conquest of Portugal by Napoleon, all Portuguese possessions in India had been occupied by British troops for their protection against possible attack by the French ; civil administration being still carried on by the Portuguese.

Crossing the peninsula in November, the party travelled from Bangalore by three different routes, and surveyed each of them[7]. During the first season the island, city, and port of Goa were surveyed on the scale of 4 inches to a mile, but as five of the military officers were then recalled to join their regiments [321], and the survey transferred to the control of the Surveyor General [322], Garling was ordered to complete the general survey on the one-inch scale. He was, however, allowed to retain the officers till the end of the rains of 1811 so that they might complete their mapping [157][8].

For the next season Garling was allowed two military officers, Lethbridge and Dunn, and three civilians, Webbe [157, 175], Terry, and Long[9], and in April 1812 he reported progress ;

The objects...have been to extend a net of triangles over the whole of the Territories—To fill up these triangles with Topographical detail—To measure the roads and to inspect the Ghauts—To compile a Descriptive Memorandum. ...

The boundary line, being made continuate across the Mouths of the Rivers, will be found to enclose an area of about 1300 miles ; of this extent there remains to be done of Topographical detail not more than 110.

The arrival of Assistant Surveyor Webbe has enabled the Survey of the roads to be commenced on much earlier than otherwise could have been done. The Principal roads, ... all the secondary Ghauts, and three of the five principal Ghauts have been measured.

The whole of the Field duties of this Survey will...be completed in the course of next month ; there will then remain to revise and arrange the Triangles—some drawing in the Topographical part, which may be done, under inspection, by the Sub-Assistants—To revise and arrange the Routes—To compile the descriptive Memorandum.

On the Sketch I have exhibited what States border on these Territories, with a view to afford the means of judging of the propriety or otherwise of extending the Survey. The Country to the South...has been surveyed under Colonel Mackenzie ; the Survey of the Soopah Country[10], as belonging to the English, and the Sattara Province as belonging to a Dependant of the Portugueze Government well disposed to the British, is undoubtedly practicable. ...

I have been along the Southern boundary of these Territories, ... and, for the more effectual junction of the Surveys, I have taken a Station on Bomanaut Gooda, ... and have intersected several more distant points which have been determined in the Map of Colonel Mackenzie[11].

[1] MRIO. M 126. [2] Ward, Dunigan, Hamilton, Summers, Howell, Ficker. [3] Lantwar, Newman. [4] MPC. 18–1–16. [5] Lethbridge, Dunn, McGlashan, Fyfe, Hancock, Perry, Conner. [6] Terry, Long. [7] MRIC M 71. [8] MMC. 17–5–11. [9] MPC. 19–5–12. [10] Supa, 48 I/11. [11] DDn. 127 (257), 10–4–12.

Garling was insistent that the party should not leave Goa before all the mapping and memoirs were completed ;

The Descriptive Memorandum has been an object of great attention ; with the materials for it fresh in my memory on the spot, ... and with the assistance of the Interpreter at hand, I shall engage in its execution under greater advantages than after delay. ... The materials of the Survey in general, collected from many hands and therefore more or less unconnected, should be perfected without that loss of time which must attend a march. ...

Terry...is very unwell of the Fever with which he was suddenly attacked a few days ago whilst under the Ghauts. Mr. Lethbridge has also been obliged to go to Cabo for the benefit of Dr. Gilmour's advice[1]. These accidents are by no means so common as the bad name which Goa has got gives most strangers to it to suppose ; compared with the country where we were about the Pollams[2], this climate may be said to be salubrious[3].

At the end of May he moved into recess quarters at Cabo;

On inspecting the work produced by the Surveyors, it has been found that a portion of that executed by Lieut. Dun is erroneous, and will require to be surveyed again [216]. The extent of this error is not more than may be obviated by one of the Assistants in three or four weeks, when the weather will permit out-duties to be engaged in. The error seems to have arisen from mistaking one point for another, but...it is quite unusual not to detect on the spot errors of such a magnitude. ...

The Surveyors will shortly complete the drawing of their work, and I hope to be able to transmit the register of the triangles with my next Report. ...

I...keep by me a connected Map of these territories, on a scale of one Inch to a Mile. Into this Map most of the sections have been sketched as soon as finished, ... which if completed would be found in every respect calculated to answer the wishes of the British Envoy...for a map to be furnished to His Excellency the Viceroy of Goa[4].

To completely finish this Map, no expense need be incurred beyond that of retaining one Surveyor until the end of August, and...I beg to recommend Lieut. Lethbridge may be allowed to remain for the period[5].

I have had the honor of a conference with the British Envoy on the subject of Surveying the Passes leading from the upper Country into the Sattara Province[6]. ... The Rana's permission to survey the Passes being first obtained, they may be commenced on in the fair interval that is looked for in August. ...

I have communicated to Lieutenants Lethbridge & Dun the arrangements...by which they are to be relieved from the Survey on the 30th instant. ... I have also communicated to Mr. Assistant Surveyor Webbe the arrangement regarding him ; an opportunity for his proceeding from hence to Bombay is not expected to occur until the latter end of September, so that his services will be available in August for assisting in the Survey of the Passes ; he is in the mean time occupied in forwarding the details of the Survey[7] [175].

Permission was given to extend the survey through the Ghāts towards the Marātha country except through the Rāmghāt Pass[8], and the Munnaree country[9] was partly surveyed in February 1813 ;

The chiefs of the District were averse to the survey being made, and evaded giving their consent until a passport had been obtained from the Peishwa.

On [my] first entering the country and sending the passport to the Dessais they behaved with a civility which led me to hope they did not regard my proceedings with much jealousy, or that they would object to my making a general survey of the Country. ... Their subsequent conduct however gradually evinced their distrust, ... and at length they gave a distinct intimation that my proceedings must be confined to the road.

Their dependence on the neighbouring state of Sawunt Warree[10] and the hostile preparations of the British Government against that State[11], sufficiently accounted for their temper, and made it prudent to quit the Munaree District without much delay ; the country has not therefore been entirely surveyed, in particular the N.W. part. ...

The Survey has been taken up from the Trigonometrical points determined on the East frontier of Goa[12].

Garling sent in his map and descriptive memoir[13] at the end of the rains of 1813 which he spent at Goa. Morison, acting Surveyor General, commented that

[1] Mad. Med ; Staff Surg., Goa. [2] in Chittoor Dist. ; 57 O. [3] DDn. 127. (259), 12–4–12. [4] MRIO. Misc. 6–0–13, 1-inch sections by Hancock. [5] DDn. 127. (287), 10–6–12. [6] Belgaum & Dhārwār Dists., 48 I; Sātāra, 47 G/14. [7] ib. (291), 19–6–12. [8] 48 I/1. [9] 48 E/14. [10] Sāvantvādi, 48 E/13. [11] Dowse's operations, [166]. [12] Memoir MRIO. M. 212. [13] Reduced Map, scale 2 miles to an inch, *IO Cat.* (460), & MRIO. 5–PT–14 ; Misc. 5–0–12, copy beautifully drawn by C. Ignatio of SGO. Madras [pl. 14]. Memoir, BM Addl MS. 14385, & DDn. 97.

"all the features of the country have been exhibited in the most masterly style"[1], and the survey was indeed the finest piece of topographical survey that had yet been executed in India; and in a hilly wooded country. Montgomerie writes of it in 1826;

This Map was prepared from the Original Survey executed upon various scales—35 sections of various sizes and scales, not less than 1 mile to an inch, forming the original Maps of the Survey[2]—It depends on a Base on the Sea Coast accurately measured by Lt. Garling. ... It exhibits every species of detail of which the Scale is susceptible...and, with its descriptive Memoirs, may be considered of the first order of Topographical and Statistical documents we possess. ...

The Goa Survey, though not grounded on Colonel Lambton's Triangulation, yet, from the Circular Instrument used by Captain Garling being of great power, and capable of measuring angles with nearly as much accuracy as Colonel Lambton's [255], and proportionate care and Skill having been devoted to the observations and Calculations of the Principal Stations, it may be considered to rest on equally well authenticated data. The Triangles were in fact adopted by Colonel Lambton [247].

The detail of this Survey was taken up by means of Plain Tables and, large scales having been used, admitted of a minute and elegant Topographical delineation of the diversified features of the Goa Territories. Besides possessing all the merits of the Military Institution Surveys, this has none of its defects; the limits of the Districts and other Divisions are shewn, the names are considered to be correctly written, and in addition to the Maps there are ample Memoirs[3].

Lambton's inclusion of Garling's triangulation of Goa and Sonda with his own work was unfortunately done without Mackenzie's consent, and greatly offended him[4].

SONDA OR NORTH KANARA, 1813–5

The district of Sonda[5], which corresponded more or less with the present district of North Kanara, had fallen to the Company at the treaty of 1799, and was administered with South Kanara from Fort St. George, Thomas Munro being the first Collector of the two areas [181]. Mackenzie had been unable to take up the survey in 1800, and his arrangement for its survey by Johnson had fallen through [96–7].

On the completion of Garling's survey of Goa, Morison recommended that his party should move to Sonda, and field work was started in November 1813, at the end of the rains, with a party comprising Garling, Conner, Terry, Long, Faulkner, Ficker, Malcolm[6].

Health had been none too good;

The indisposition of John Terry had increased in delirium and other symptoms of such an alarming nature, as in my mind to render the constant attendance of Richard Long near him; Terry is now convalescent, and may probably be given Medical Certificate [363][7].

The weather having cleared up, the Lascars were dispatched on 23rd to make the necessary preparations by placing flags. ... I quit Goa this evening for Markunny Station[8].

John Terry has so far recovered as to resume duty; has been sent to Hullial[9], as the least unhealthy area. I have hired 4 lascars to be attached to him. ... Richard Long will accompany the Superintendent to be instructed in the use of the large theodolite[10].

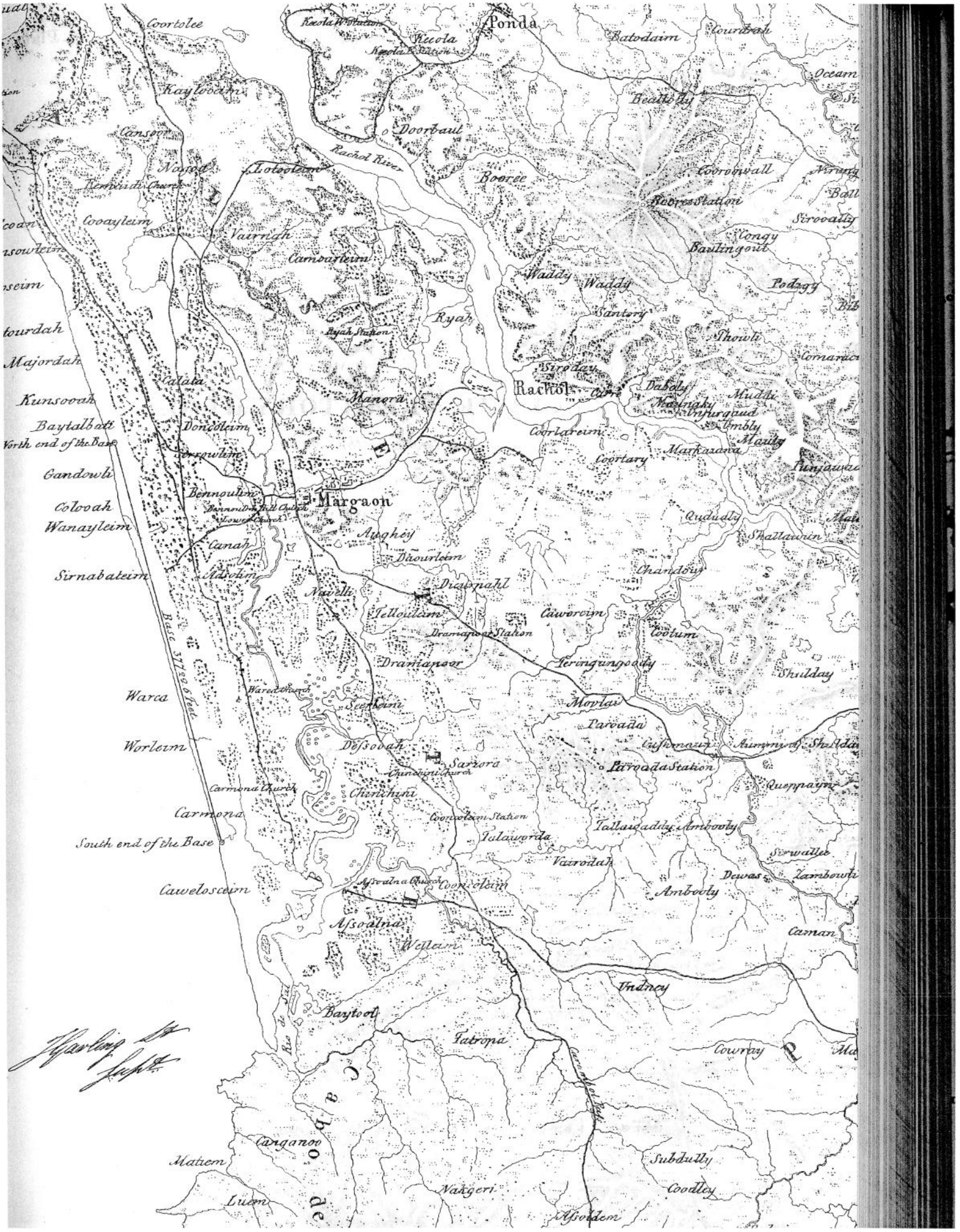
On December 5th Garling reported that Faulkner and two sub-assistants were sick at Haliyāl. Terry was at work and

Richard Long has been employed on Topographical detail. ... All flags are now removed from Portuguese Territory, and the survey is now independent of further communication with it.

Terry was sent down to Madras with asthma, and

after some preliminary training Faulkner and his two Sub-Assistants...started work. ... Survey completed by Terry round Hullial has been lost. Terry reports that the evening

[1] from SG. 20–2–15. MPC. March 1815. [2] Map in 37 sections by Lethbridge; 2 inches to a mile, 1812; MRO. Map 680. [3] DDn. 246 (99). [4] DDn. 149 (51), 23–3–19. [5] Sonda Village, 48 J/14. [6] 48 J/15. [7] Descriptive Memoir, M 203; DDn. 98 (1). [8] MRIO. M 567, 2–9–13. [9] on Goa border, 48 J/7. [10] Haliyāl, 48 I/15. MRIO. M 567 1–10–13.


Ponda
Coortolee
Kayloodem
Cansoor
Nagod
Coayleim
Vairnah
Camparleim
Ryah
Manora
Margaon
Bennoulim
Canah
Sirnabateim
Warca
Worleim
Carmona
South end of the Base
Cawelosceim
Asoalna
Baytool
Patropa
Canganoo
Matiem
Luem
Nargeri
Afsoldem
Subdully
Coodley
Vndney
Caman
Dewas
Ambooly
Tallaudaddy
Vairodah
Tulawarda
Concolem Station
Cherichini
Sarzora
Desoovah
Parvada Station
Parvada
Movlai
Seeroleim
Dramapaor Station
Dramapaor
Tellouleim
Nauelli
Dicarpahl
Aughey
Daourleim
Canah
Malolim
Bennoulim
Margaon
Gandowli
Baytalbatti
Majordah
Tourdah
Kunsoovah
Coloovah
Wanayleim
Base 37728.6 Feet
Rachol
Siroday
Waddy
Santory
Ryah
Booree
Doorbaut
Rachol River
Nagod
Camparleim
Vairnah
Coayleim
Kayloodem
Coortolee
Ponda
Batodaim
Beatti Ry
Coorbarl
Ocean
Coorbwall
Bobres Station
Congy
Baulingout
Podgey
Showli
Comanca
Daboly
Muddi
Umbly
Maully
Markazana
Coortary
Coorlareim
Cuduldy
Shallawim
Chandour
Caworcim
Cootum
Teringungoady
Shulday
Mowlai
Parvada
Caishmaury
Aimmuly
Shaldai
Quenpaym
Sirwaddo
Zambowli
Caman
Vndney
Courtay
Subdully
Coodley
Afsoldem
Nargeri
Matiem
Luem
Canganoo
Patropa
Baytool
Asoalna
Cawelosceim
Carmona
South end of the Base
Warca
Worleim
Sirnabateim
Gandowli
Baytalbatti
Majordah
Tourdah
Kunsoovah
Coloovah
Wanayleim
Canah
Malolim
Bennoulim
Margaon
Dicarpahl
Nauelli
Tellouleim
Dramapaor
Aughey
Daourleim
Seeroleim
Desoovah
Sarzora
Parvada
Movlai
Teringungoady
Caworcim
Chandour
Cuduldy
Markazana
Coortary
Coorlareim
Maully
Umbly
Muddi
Daboly
Siroday
Rachol
Waddy
Santory
Ryah
Booree
Doorbaut
Rachol River
Nagod
Camparleim
Vairnah
Coayleim
Kayloodem
Coortolee
Ponda
Batodaim
Beatti Ry
Ocean
Coorbwall
Bobres Station
Congy
Baulingout
Podgey
Showli
Comanca
Shallawim
Shulday

MAP

of the

PORTUGUEZE TERRITORY at GOA

shewing also the
roads and principal features
of the Sattur & Munnaree
Districts
the whole
Surveyed under the immediate Superintendance
of Lieut.t James Garling of the
Madras Establishment

Surveyor General's Office
Fort S.t George 29.th May 1814

W. Morrison
Act.g Surv.r Gen.l

Scale of 2 Miles to an Inch.

From Garling's half-inch map reduced by Christopher Lethbridge from surveys, 1811–12, scale 2 inches to a mile, and copied at Madras in 1814 by Christian Andreas Ignatio [157*n.* 12; 158*n.* 2]

Note the base-line on the beach.

previous to his intended departure from Hullial, his survey was put in the usual place, and that in the morning it was missing. ... If nothing transpires in a few days, I shall consider it more advisable to survey the ground again; it will take six weeks to make good the loss[1].

An escort was provided and Garling asked for it to be continued during the rains;

The Office for the Soonda survey will at Onore[2] be quite a distinct Building from the dwelling house. I beg therefore that the Guard would be continued to the survey during the Monsoon, or...that measures may be adopted for having a sentry posted over the Office during the night, as that place will be the repository of the Papers and Instruments of the Survey[3].

The survey was completed by the close of the second field season and, reports the Surveyor General,

the approaching Monsoon rendering it necessary to retire from that woody unwholesome tract, I approved of Lieutenant Garling's removal in May last with the Establishment to Chitteldroog[4], to bring up there the necessary plan work, Memoirs, and computations; these always require time and convenience at the termination of the field work. ... The ill health of the party also rendered this necessary, as several were taken ill, and one of the Native Assistants was permitted to go to the Coast for his health; another having been permitted to go to Bombay returned here in June[5].

It was not until September 1815, nearly five years after leaving for Goa, that Garling returned to Madras, with reputation as a topographical surveyor second only to Mackenzie, and a mass of valuable material;

The greatest part of the results of this survey has now come into the Office; with 4 Volumes of Memoirs and all the sections; and two maps of the Soonda District on a scale of one and two Miles; these are also put in hand in Office to prepare fair copies[6].

The maps, and especially the hills, are beautifully drawn, shewing considerable detail in spurs and minor streams, but with no definite heights. The title-page of the first volume of Memoirs reads;

Soanda Survey. Descriptive Memoir, Part the 1st. Containing Remarks Illustrative of the Map; General Account of the Districts of Soanda & Bilgy. General Account of the Countries surrounding the Soanda District. Account of the Traverse of Soanda. Account of the Rivers of Soanda. Chittledroog. July 7th 1815[7].

NORTHERN CIRCĀRS

There is little to tell of surveys in the Northern Circārs during this period. In 1805 the question of harbour accommodation along the east coast was raised once again [I, 101–3], the admiral "on the Coast" sending to the Governor a

copy of a letter...from Mr. Ebenezer Roebuck[8], who has Constructed a dock at Coringa[9]; you must be attached to having a good port on this side of India to refit and repair His Majesty's ships in. ...

The subject then being of considerable and material importance, I beg...you will appoint a gentleman properly qualified to survey the River, Dock, and Bar, and examine into the grounds and solidity of Mr. Roebuck's proposition; likewise to suggest any mode by which it may appear probable to deepen the water on the Bar, and render the Passage up the river more convenient[10].

Warren carried out this survey in his capacity as Marine Surveyor [I, 174; II, 195], and went on to survey "the roads of Vizagapatam"[11]. On his return in June 1806, he submitted an elaborate report on his work[12], concluding that,

in the then state of the Flat at the entrance of the Coringa River, any vessel not drawing more than 12′ 6″ of water, may easily enter in two springs at any time of the year[13].

The Madras Government of 1855 considered that Warren's report contained information of such value that they published it with Topping's report of 1789 [I, 103, 191–2] and later reports they had just received.

[1] MRIO. 567 2–1–14. [2] Honāvar, 48 J/7 [I, 125; II, 108]. [3] MPC. 3–6–14. [4] in Mysore, pl. 11. [5] MPC. 12–1–16. [6] MRIO. 122 (3), 126 (17), MRO. Map. 231. MPC. 12–1–16. [7] DDn. 98, M. 203; see also BM Addl MSS. 14376–8, purchased from T. B. Jervis. [8] Son of Dr. John Roebuck (1718–94), *DNB.*; bro. of Benjamin (1754–1809), MCS.; arrd. Madras as Free Mariner 1799; m. Zippora, dau. of Richd. Tickell (1751–93), *DNB.*, uncle to the survr. [65]; d. 1807. [9] 65 L/1. [10] MPC. 24–7–05. [11] ib. 25–9–05. [12] *Plan of the Flat in Coringa Bay*; MRO. Map 107; MRIO. 101 (18). [13] *Mad. Sel.* XIX (2).

The Madras Record Office holds a map of "the Zillah of Rajahmundry, shewing different zamindaries", signed 23rd June 1807 ; scale one coss to an inch, in two sheets[1]. It is a skeleton map shewing main rivers, roads, village sites with names, and conventional hills. It is unlikely to have been surveyed by any of the assistant revenue surveyors who generally used scales in miles.

Morison gives the following description of the surveys of the Northern Circārs used for his maps of the Military Divisions [162, 276–7] :

The map of the Northern Division has been prepared under many disadvantages. A variety of materials have been brought into use. Their value in many instances is of a doubtful nature, and it has been found difficult to reconcile or connect them with one another ; some are even without scales, and none are accompanied with any Memoirs which illustrate their history.

Every attention has however been paid to the selection of those which have appeared to be most authentic ; and, having obtained from Mr. Goldingham...a series of longitudes and latitudes determined by himself and the late Mr. Topping along the Coast from Masulipatam to Ganjam [I, 104–5, 192], the disagreements in connecting the results of the different plans have been corrected as far as practicable.

The map...is much more complete than any which has yet been formed of this Division, and, although it must be considered much inferior to the maps of the other divisions, it affords information upon which considerable reliance may be placed ; as such may be mentioned the plan of Chicacole[2], Bomally, and Tekelly, the whole of which has been adopted [I, 93]. The Ganjam or Itchapore District is laid down from a copy of Cotsford's map, which appears to be authentic [I, 93].

The Vizagapatam District by Lieutenant Douglas appears to be a series of routes in various directions, and contains much information which has also been included, though some difficulty was experienced in adapting it to the points fixed on the Coast by means of the longitudes and latitudes.

Parts of Colonel Pearse's route from Madras to Bengal [I, 40–2] have been adopted when better materials were wanting, and all other routes which extend inland have been laid down. ...

The map of the Masulipatam and Ellore Circārs by Messrs. Topping, Beatson, and Caldwell, has also been adopted, though far from being a complete survey. I have ascertained that no triangles were carried on in its progress, and that it is chiefly formed by means of a general connexion of routes, and several series of levels taken in various directions through the Districts between the Kistnah and the Godavery [I, 106]. ...

Much remains to be done in this Division, and I trust it will be practicable at no distant time, to allot an establishment of surveyors to such of the districts as appear to demand most immediate attention, if not to commence a general survey of the whole of the Circars[3].

The survey by Alexander Douglas was carried out during 1810 and 1811, and bears a note acknowledging "a sketch of the Golgondah Zemindari[4] drawn by Captn. Stewart of the 1st Bn. 21st Regt., 1810"[5].

MACKENZIE'S REVIEW, 1810

The year 1810 was a great landmark in the history of Madras surveys. In August an important report on the reorganization of the military departments was presented by General Hewett[6], Commander-in-Chief Bengal, who had been deputed for the purpose, and it was on his recommendation that Mackenzie was appointed Surveyor General [298–9], with control of all the surveys and establishments which had grown up under the Revenue Board and the Quartermaster General [3, 299–301].

One of Mackenzie's first actions was to make a careful investigation of surveys and maps already completed or in progress, and to work out the future programme [302–3]. His first review is dated 29th November 1810[7] and, like all his reports, goes into the minutest detail and is of inordinate length. He discusses

[1] MRO. 96. [2] 65 N/15 ; Tekkali, 74 B/6 ; There is a delightful little ½-inch sketch of Chicacole area without survr's. name, or date ; MRIO. 10-PT-18. [3] MMC. 26–8–14. [4] 65 K/6. [5] Map, MRIO. 147 (31–3). [6] Sir George Hewett, C-in-C. Bengal 1807–11 ; Madras, April to September 1810. [7] MRIO. M 60.

the materials surveyed by the establishments now existing, in some measure proposed to be new modelled & reduced to a system ;

1. The Military Surveys carried on under the Quarter Master General since December 1806.
2. The Revenue Surveys under an Inspector of Surveys since 1798.

Both of these have gone on the same foundation of a *General Geometrical*, & more latterly of the *General Trigonometrical Survey*.

In the military surveys, while the Gun & Carriage roads, the Passes, Defiles, & Fords, the accurate positions of Forts, Towns, Markets, would be primarily attended to, the Boundaries of Provinces and of the Districts, lately required in the Revenue and Judicial Departments, would scarcely be considered objects of the first consideration.

On the other side, the Tanks, Channels, Nullahs, & even wells, & the quantity & kinds of arable & waste lands, the soil, cultivation, weights & measures, & various minutiæ connected with Revenue have required more scrupulous attention.

While, in both, the Rivers & Tanks, the seasons of their filling and of the rains, the most considerable towns, Marts, &c., would be subjects of investigation, together with the General Geological features.

There is reason to think that, independent of the incompetency to such serious duties, and of the early age of the native Sub-Assistants sent on these surveys, under no immediate professional control or observation, that the objects belonging to each may not have been so nicely discriminated. ...

In tracts of country minutely surveyed by the Military branch, the interior limits of districts may have been omitted as unimportant [129]. ... Roads and defiles may have been passed over by the Revenue Branch for want of that experience which could not have been expected from the tender age at which young natives, little conversant with such subjects, were sent out by themselves [2, 184].

Mackenzie then makes "a rapid view", and estimates the area of territories under, or in alliance with, the Madras Presidency, including the Northern Circārs, to be roughly 1,69,691 sq. miles.

The Survey of the Mysore Dominions may be considered as the Central Nucleus on which the several parts may depend ; ... as a kind of Model example by which former errors have been cleared (breadth of peninsula [I, 179 ; II, 104]), and considerable lights have been derived on various subjects. ... The whole of the Rajah's Dominions have been actually geometrically surveyed, Memoirs and Plans submitted to Europe, and the original documents...now...being placed in Depot.

Coimbatoor ought to have made part of the Mysoor Survey, but a survey under the Revenue Branch having been early commenced there after its reduction in 1799, it was thought proper to turn all the early efforts of the Mysore Survey on to the Northern & Central parts. The reduction of the Mysore Establishment in 1802 [330–1] rendered it inconvenient to go in. ... The hilly tracts adjacent to Mysore ought to be particularly examined & the obscure avenues through it better known.

Dindigul is in the same predicament, as Roads & Passes, are well known, but the extent of Survey under the Revenue Institution is uncertain [140].

The trigonometrical basis established by Major Lambton's survey, having been extended to the West Coast, will...remove the effects of any errors resulting from diversity of operations, or inferiority of instruments ; ... these several surveys being carried on the same parallel to the East has now put the actual breadth of the peninsula in these parts out of all further doubt [I, 179 ; II, 104, 238, 241], & has laid the ground work of a Survey of the whole tract from the Pennar to the Coleroon.

The Province of Arcot, not long ago the principal seat of the Government of the Carnatic, & the great field & object of our Politics and Military Movements for several years, might... have been an object of the earliest consideration ; yet, notwithstanding several attempts (Kelly, Schlegel, Pringle, Beatson, Allan [I, 95–9, 109–11]) to carry on surveys along with our armies, ... the more remote parts were not examined with that accuracy that the subject deserved. Though several marches and routes were measured and surveyed by Pringle, Beatson, Allan &c., no regular geometrical survey of this country was ever attempted till after the establishment of the Military Institution, when their first parties were sent to exercise themselves in the districts extending from Madras to Pondicherry and Gingee on one side, and towards Arcot, Chitoor, & Nellore on the other [125–8]. ... Future parties should fill up whatever remains of the country South of the Coleroon, West of the limits of Salem & Barramahl, & North to the Pennar. ...

The Provinces of Tanjore, Trichinopoly, Madura, Rameswur & Tinnivelly were already deemed of that importance that their roads were repeatedly surveyed in the several campaigns made in these countries during the wars down to the last campaign in 1801 [123]; various plans by Call, Wersebe, Byres, Allan, Jennings [I, 87, 98, 110], were deposited in the offices of Government, but no regular survey was undertaken, tho' repeatedly suggested, until...from 1798 several parties from the surveying school were sent thither at different times, whose labours are still carried on.

At present the rich district of Tanjore is completely surveyed, to which that of Trichinopoly is also added [146–7], both districts being watered by the Cavery, whose means of fertilizing the country serves an important object of Hydrographic & Statistical Survey in addition to the geographical. Madura is also said to be surveyed [140]. Tinnivelly is in considerable progress, and parties are sent into Ramnad & Sevagunga [141–6]. ...

The extension of the Trigonometrical survey into Travancore, carried along the West coast, & forming a junction with the Malabar Survey, will confirm or correct what has been done already. ... A military survey appears to have been established under cover of the subsidiary force since 1806, and assistants from the Military Insititution having been added for 2 years back [131–2]. ... When we recollect that Canara, a country of 5000 miles sq., much of the same nature, was completed in 6 months of fair season by a party of 6 or 7 [108–11], it is not unreasonable to expect that Travancore, 7500 sq. m., should be completed within a proportionate space of time, under a proper direction[1]. ...

Notice should be taken of that immense space lying directly behind the Circārs, which, tho' so very near our limits, & immediately bordering, seems to be less known than any one part of India at present. The country between the Circars & Berar should be explored, at least by rapid journeys from several surrounding points. ...

In the Deckan...the only surveys hitherto conducted have been effected by Routes, Marches of Armies, corrected by some observations rather than by any regular Geometrical process. Previous to 1800 I am competent to speak, from having made it a particular subject of enquiry [I, 116–7], but since 1805 the direction has been transferred [132–4]. ... The greater part of the Provinces South of the Kistna have been actually surveyed in detail, tho' some parts may have been executed in a manner...less correct than others [150–1].

Mackenzie continued by urging that the whole country south of the Coleroon should be completed with the aid of Lambton's triangles and with personal inspection by the Surveyor General. The survey of Arcot should be completed by the junior members of the Military Institution on their annual training, and the civil revenue assistants should be employed on the survey of Ongole and Guntūr, thus completing the whole country south of the Kistna in two seasons. The survey of the Circārs would then follow, with that of Goa and other foreign settlements, and then the Deccan. He was an optimist.

After discussing the supply of "native assistants" from the Surveying School, and the instruction of officers at the Military Institution[2], he recommended that two officers should be appointed as Surveyors charge of the more distant surveys be given definite status, in each with a small establishment.

A later review was made by Morison in 1814, when submitting maps of the Military Divisions [160, 276–7][3] and on his return in 1815 Mackenzie took up the whole subject again, and submitted[4]

a sketch of the Southern portion of the Peninsula of India, showing the different surveys executed[5]. ...

The Establishment of this Office of Surveyor General has at least had one...very important advantage; of combining for the first time into one General Body the results of all the surveys executed in the Peninsula since the first acquisition of Territory from Mysore in 1792 [I, 113, pl. 1], the whole of which in this map are distinguished by colours of different shades, the parts unsurveyed being left blank. ...

Of this, 76,507 square miles are accompanied by a considerable body of information, Geographical, Statistical, and Historical, some of which has been already transmitted home, and much of the materials still remain to be arranged, translated, and digested. ...

[1] Ward's party surveyed Travancore in 4 seasons, 1816 to 20. [2] Making no claim to personal credit for its foundation [124–5]. [3] MMC. 26–8–14. [4] MPC. 12–1–16. [5] map, 48 m. to inch MRIO. 136 (31); MRO. 18.

Of the Provinces and Districts following, Geographical, Statistical, and Historical Memoirs are already formed, or in preparation ; ...

Barmahl	sq. miles	6,400	Ceded Districts	sq. miles	28,989
Mysore	,,	32,000	Goa, Sutter, & Manara	,,	1,522
Canara	,,	4,801	Soonda & Bilghi	,,	2,795
		TOTAL 76,507			

He gives the following list of Provinces, taken from south to north;

		Surveyed *Estimated Sq. miles*	Unsurveyed
Southward			
Tinnevelly	[140–6]	5,599	...
Travancore.	[130–2]	595	6,761
Madura, Sevaganga, Ramnad	[140]	6,508	...
Dindigul, now under survey	[139–40]	3,446	...
Tanjore & Tondiman's Country	[146–7]	5,145	...
Trichinopoly	[147]	2,094	...
Coimbatore	[147–9]	8,640	...
Westward			
Malabar (Geographically Surveyed)	[I, 130–2]	5,562	...
Canara	[108–11]	4,801	...
Soonda & Bilghi	[158–9]	2,795	...
Koorg	[105–6]	...	2,218
Wynaad	[123]	...	1,638
Goa	[156–8]	1,192	...
Maratta Districts of Sattar & Manara	[157]	330	...
Center			
Arcot Soubah, from the Coleroon to Arcot, including the Jaghire, a portion unsurveyed	[125–7, 149–50]	14,143	1,776
Western Poligars, Venkatgherry, Calastry, &c., included in the different surveys	[127,155]	...	...
Nellore, Ongole	[149]	5,350	...
Palnaad (surveyed by Capt. Beatson)	[I, 110]	1,560	...
Baramahl	[I, 113–4]	6,400	...
The Ceded Districts	[152–6]	28,989	...
Mysore Rajah's Country	[91–121]	32,000	...
Northward			
Guntoor (excepting partial surveys & routes)	[I, 112]	1,206[1]	2,577
Northern Circārs	[159–60]	...	14,800
	TOTAL	1,36,355	29,770

ESTABLISHMENT, 1811

The following statement, compiled from the Surveyor General's quarterly reports[2], shows the work going on during 1811 and 1812.

Surveyor General's Office

Surveyor General—Lieutenant Colonel Colin Mackenzie (absent with expedition to Java).

Acting—Major William Morison.

Assistant in the Office—Ensign Benjamin Ward.

Surveying School

Assistant Revenue Surveyors—William Scott ; Silvester Pope ; James Allen ; Charles Baillie.

Apprentices—Thomas Anderson ; Charles Barnett.

Observatory

Acting Astronomer—Captain John Warren ; with 2 Brahmin Assistants.

Ceded Districts

Superintendent—Lt.-Col. Mackenzie (as above).

Assistant Revenue Surveyors—Michael Dunigan ; James Summers ; William Howell ; Henry Hamilton.

Apprentice—Frederick Ficker and 13 interpreters.

Southern Surveys

In Tinnivelly—John Robinson ; Thomas Hill William Bird ; William Fletcher.

In Coimbatore—William Keyes ; Charles McMahon.

[1] by Military Institution 1815–6. [2] MPC. 457/1811 & 392/1812 ; From SG. 23–8–11 & 17–3–12.

In Madura—Thomas Turnbull; Christian Pereira; George McKay; James Aikin; Andrew Chamarett.

Department of Tank Repairs, Nellore and Arcot [149]
Superintendent—Major J. L. Caldwell.
Assistant Supt—Captain Fotheringham.
Sub-Assistants—James Ross; Joseph Jelly; William Cameron; William Meade.

With Collector of Madras
Assistant Revenue Surveyor—J. A. Johnston.

With Superintending Engineer, Fort St. George
Assistant Revenue Surveyors—Henry Lincoln; David Ross.

With Expedition to Java
Chief Engineer—Lt.-Colonel Mackenzie [135].
Assistant Revenue Surveyor—John Faulkner.
Sub-Assistants—John Malcolm; William Lantwar.
Draughtsman—John Newman (from Ceded Districts).

With Expedition to Bourbon
Sub-Assistant—C. M. Campbell.

With Malcolm's Mission to Persia [175]
Assistant Revenue Surveyor—William Webbe.

Trigonometrical Survey
Superintendent—Major William Lambton.
Assistants—Lieutenants John Riddell & J. T. Hodge.
Assistant Revenue Surveyors—Joseph De Penning; Peter Lawrence; Joseph Olliver; William Rossenrode.

Military Institution
Superintendent—Captain Anthony Troyer.
Assistant Instructor—Lieutenant Henry Walpole.
Assistant Revenue Surveyor—Marcellus Burke.

Goa Survey
Superintendent—Lieutenant James Garling.
Assistants—Lieutenants C. Lethbridge; C. D. Dunn; R. McGlashan; J. Fyfe; E. J. Hancock; J. Perry; P. E. Conner.
Sub-Assistants—John Terry; Richard Long.

With Quartermaster General's Department
Assistants—Lieutenants C. L. Nelthropp; M. H. Davidson.
Assistant Revenue Surveyor—Samuel Godfrey.

Northern Circārs. Lieutenant A. S. Douglas [160].

CHAPTER XII

BOMBAY & PERSIA

Military Routes — Forest Surveys — Sind, 1809 — Kathiawar & Cutch, 1807–10 — North-West Gujarāt, 1809–10 — Missions to Persia.

AT the opening of the 19th century the only territories administered by the Bombay Government were the islands of Bombay and Salsette, the district of Surat, and the province of Malabar which was transferred to Madras in 1802 [150]. In the same year certain districts in Gujarāt were ceded to the Company by the Peshwa and the Gaeckwar of Baroda, and the cession was confirmed by treaties made in 1805 at the close of the Marātha War, throughout which the Gaeckwar remained a firm ally of the British [I, 57].

Up till 1807 Charles Reynolds continued as Surveyor General, and was wholly occupied with the construction of his great map, for which his Indian surveyors continued to bring fresh material till his departure from India [I, 132, 217–9; II, 7, 282–3; pls. 3, 15].

The campaigns of 1803–5 gave opportunities for the survey of many routes, and the best known of the Bombay surveyors was John Johnson, senior engineer to Arthur Wellesley [57], who commanded the Guides and led all the survey and reconnaissance[1]. Wellesley insisted on the upkeep of surveys;

Our way was to be felt by information obtained on the spot; every inch of the ground passed over was to be accurately surveyed, and Plans were to be made of every encampment.

Blakiston tells of a strenuous ride from Berār to Poona;

When within about 120 miles of Poonah, the General, finding that his presence was required both there & at Bombay, pushed on with a small escort for Poonah. As the force was to proceed by a different route, I was ordered to accompany the General. But I think I never had so difficult a task in my life. I had to survey accurately the road for the distance, on an average, of 25 miles a day for 5 days successively, while to add to my hardship, towards the latter part of the march I was attacked with guinea-worms in my legs, so that I could hardly dismount from my horse. ... Had I been able to accompany the General to Bombay, I might have become his A.D.C.[2]

At the close of the war Johnson compiled a *Map of the Seat of War in the Deccan, comprising the Peshwa's and Nizam's Dominions*, scale 8 miles to an inch[3]. He included Emmitt's surveys of 1791–2 [I, 128–30]; surveys by Reynolds and Mackenzie; the eastern boundary of Berār by Lutwidge [134], and the remainder from his own surveys and those made by James Colebrooke with the Hyderābād Subsidiary Force [133].

An account has already been given of the survey from Gujarāt to Bharatpur made in 1804–5 by Byers and Sealy [54]. The route of the main column from Baroda[4] was surveyed by William Cowper, who describes

surveys taken with the Division of the Bombay Army under Maj. Gen. Jones during the late war against Jaswant Row Holkar [57]. The very imperfect knowledge we had of these countries was my inducement for undertaking this survey under several disadvantages. ...

In many parts the survey, from local obstacles, has been entirely confined to the route of the army. Whenever occasion offered of extending and carrying it on in a more regular manner, I have always seized the opportunity. ...

[1] Gurwood, III (521), 15–3–03, etc.; surveys include MRIO. 65 (5); 119 (13). [2] Blakiston, I (106, *et seq*). [3] MRIO. 123 (11). [4] Reached Bharatpur, then under siege, 10–2–05.

Unfortunately I had no Instruments with me for ascertaining either the Latitude or Longitude. ... I have therefore preferred giving in the accompanying as a plain Survey, rather than mislead by affixing the degrees to it. ... I have been unwilling to lay down any places from report, but confined myself entirely to my own surveys, with the exception of Ajmeer, &c., which I inserted to shew their relative situations. ...

The route from Delhi to Kanoon is from an Assistant Surveyor with Colonel Ball's detachment, in their advance against Holkar's Infantry and Guns [Francis White, p. 59], at the same time that the division of the Bombay army moved northward from Toank[1]. I have laid it down with my survey, as it corrects it with a principal place whose situation must no doubt be accurately ascertained[2].

The following letter explains how two Madras officers, Jourdan and Hanson, came to be surveying marches of the Poona Subsidiary Force through Khāndesh and Berār [50 n.5, 134].

The movement of the Poonah Subsidiary Force into a Country unexplored by our troops and almost unknown, and the want of Officers...qualified to survey its marches, have induced His Excellency the Commander-in-Chief [Madras]...to recommend that two Officers from the Military Institution of this Presidency may be attached...to the portion of the Poonah Subsidiary Force furnished from this establishment. This arrangement, ... combined with the proceedings of the Officers of the Institution attached to the Hyderabad Subsidiary Force, would contribute to secure the early attainment of an extensive Geographical knowledge of the Northern parts of the Dekan[3].

Other Madras officers, Thomas Davies and Evan Macpherson, surveyed routes through Sāvantvādi[4] with Colonel Dowse's Madras force in 1812 [157]. Dowse records that Elphinstone, Resident at Poona, had

intimated a wish to be furnished with any geographical materials it might be in my power to collect...for the information of the Residency, in the event of these countries becoming in future the scene of Military Operations. ... I directed the Quarter Master of Brigade to indent upon the Office at Bellary for an additional Perambulator, which has been received with the usual proportion of lascars required to run it, and I propose...to employ Lieutenant Davies... to survey the Roads branching from the direct route of the force to the principal military posts in Savanore and the adjoining Districts.

The actual Route of the Force is measured and surveyed by the Officer appointed to accompany it as Military Surveyor, but it will not be in his power to survey without assistance the roads on either side of the Route[5].

As "military surveyor" [*inf*], Macpherson surveyed the main routes "through the Southern Mahratta Country", as well as "North of Goa"[6], whilst Davies, with the wider task, completed a

Map of routes through part of Southern Mahratta Country, together with the measured distances & descriptions of the country[7].

The routes were measured by Perambulator, and the bearings taken by a common Pocket Compass, & these bearings & distances worked on the principle of the traverse table [217]. ... However equal to answer Military purposes the map may be, it cannot be considered as affording a correct Geographical knowledge of the country.

Observing from Capt. Johnson's Map [165], the only one I have seen of this part of the country, the very little information...west to the grand Northern road that leads to Poonah, I turned my attention to obtaining information respecting it, and in examining the passes through the Western Ghauts.

I wished much to mark on the map the boundary lines of the Country belonging to the different Chiefs, but this I found to be absolutely impossible, as they really possess no such line, their villages being completely intermingled [91–2]. ...

Frequently I had to quit the camp for gaining information respecting a country in which there was a possibility of the force being employed, ... and not to wait to survey the country thro' which I had to pass. On an excursion into the Concan I travelled 250 miles without surveying a mile. ... I would not upon any account have you think that I had not made the best of my time[8].

The reference to Macpherson as "military surveyor" means that he was a Q.M.G's. man, whereas Davies was the Surveyor General's man, a distinction but

[1] Tonk, 45 N/16. [2] B Pol C. 3–7–06 (98). [3] MMC. 10–1–09. [4] 47 H, 48 E. [5] From Dowse to Mil. Sec., 11–10–12, MMC. 30–10–12. [6] DDn. 246 (140, 151). [7] MRIO. 118 (24); M. Pol C. 25–11–16 (9). [8] Davies to SG. Madras ; 24–9–14 ; MRIO. M. 188.

recently introduced to the Madras army [321–2]. The Bombay Government made a similar distinction on the advice of Williams, who, soon after becoming Surveyor General, recommended the adoption of the Bengal regulations about military route surveys [123], painting this gloomy picture of a commander without maps ;

An officer under the misfortune of this deficiency is evidently sent to find his way in the dark; a cloud of midnight obscurity hangs over the theatre of his operations, and he does not take a step with security or confidence. He knows nothing of the obstructions that nature has planted in his road, and enterprize becomes incompatible with the caution his ignorance renders indispensibly necessary. ...

The unvaried and rapid success of the greatest general of the present age, which has gone on to a pitch to be the scourge of a world, is known to be eminently owing to his superior maps and knowledge of the ground over which his Hosts are spread[1].

The Bombay Government had ruled that military route surveys were the concern of the Quartermaster General, but should be communicated to the Surveyor General for map-making purposes[2].

In a report dated 1832, Jopp describes many of the Bombay route surveys, particularly those by Johnson, as being

of a superior description, and...available for the purpose of the Great Map of India[3] if they could be properly connected together, and their distances and directions checked by the aid of trigonometrical points.

Besides these routes there are a great many others of a very inferior description, some of whose bearings have been ascertained by the common pocket compass, and others laid down principally from native information[4].

FOREST SURVEYS

The Company had always been interested in the supply of teak for shipbuilding [I, 303], and in 1801 the Bombay Government appointed an officer to examine the teak forests of Malabar[5]. The Directors asked that the sale of the timber should be placed under Government control[6], and followed this up in 1805 by asking for "some well-digested and Oeconomical plan for Working the Forests and regulating the Trade"[7]. A committee was thereupon appointed

to Survey the Teak Forests in the Province of Malabar...[and] to report the growth and availableness of the Forests...for the purposes of Ship building ; ... the Rajah of Travancore having willingly agreed to the Survey of the Travancore Forests, which it will accordingly be our object...as soon as the Commission shall have completed the Survey of your own part... of Malabar[8].

Johnson, who was "understood to possess much local information of the state and resources of the Timber Forests", recommended that

the Surveys of Capts. Moncrieffe, Emmitt, and Johnson be collected (and hereafter formed on one scale into a map) to accompany the Commission [131–2]. ... Very accurate and nearly sufficient Geographical knowledge is now in our possession to give a good general idea of the extent of the Forests, and I do not think it possible...without loss of time...to add more to it than by the method described. ... Follow up one river and down the next, Mr. Solomon keeping a regular survey of the route marched by the Commission[9].

The Forest Committee reported later that

Our Assistant Mr. Solomon has been employed in constructing a General Map of the Province from the materials in the Principal Collector's Office, ... and he is now preparing separate outline sketches of the different Districts supposed to contain Timber[10].

Johnson held charge of the survey and extraction of teak in Kanara and Malabar from 1805 till 1808, and was succeeded by Goodfellow, who in 1809 submitted

a Survey of the Teak Forests in the District of Palghaut, scale $1\frac{5}{8}$ miles to an inch [bearing a note] 'The Forests and means of transporting therefrom being the sole objects in the survey, no attention has been paid to the adjacent cultivated country'[11].

[1] Bo MC 3–4–07 ; is this explanation of Napoleon's success supported by other evidence ? [2] ib. 29–4–07. [3] $\frac{1}{4}$-inch *Atlas of India*. [4] DDn. 235 (20), 3–5–32. [5] BPC. 8–9–01. [6] CD. to B. 31–12–01. [7] CD. to Bo. 3–7–05 (22). [8] Bo to CD. (Pub), 22–2–06 (30). [9] HMS. 493 (143), 9–9–05. [10] ib. 28–11–05. [11] *IO. Cat.*

Other surveys were made by Thomas Pierce, and the Bombay Government write in 1811;

Considering the disappointments experienced by your Hon'ble Court in the non-receipt ...of Lieutenant Pierce's Map, and that by Major Johnson, of the forests in Canara, ... both ascribable to our too great complaisance in allowing the officers more immediately interested in these compositions to be themselves the bearers of them, we have determined no longer to yield to the importunities of this description, but to forward all such documents in future in the public packet[1].

In 1807 Thomas Thatcher, designated Inspector of Forests, and Robert Campbell, were deputed to survey the forests belonging to the Rāja of Dharampur[2]. Thatcher was directed to survey "the forest lying within the Hon'ble Company's possessions between Parnella and the Nerbudda, particularly the large one of Ramnaghur"[3], and to report on the prospects of obtaining "teakwood calculated for building ships for His Majesty's Navy". In his interesting reports made to the Superintendent of Marine between October 1807 and April 1808, Thatcher notes that the Dharampur teak forests,

exposed to the Merchants on every part of the Coast, & to the Shipbuilders of Damaun, ... have been almost completely deprived of their finest trees. Towards the Eastward there are few signs of the Axe's destructive power and nearer the Ghaats the forests have been protected by the savagery of the Bheels [I, 126]. ...

There is a great abundance of Teak...in the Rajpeepla country. ... The difficulties of conveyance are so great that the merchants are compelled to saw Trees from 30 to 80 yards long into logs of from 10 to 15 yds., which are conveyed about 15 miles to the nearest channel leading to the River Nurbudda.

He reports that he had examined several of the larger streams and found them unsuitable for floating down rafts or even single logs[4].

Williams also records that,

between the beginning of April and beginning of June 1811 I was actively employed on a personal examination of the teak forest lying between Bombay and the Nerbudda, and on gaining information of the mode in use of cutting and transporting the timber to the sea coast[5].

From this survey, near Bulsār, he completed a map "from Bombay to Rajpeepla and the Nurbudda" on the half-inch scale[6] [pl. 15].

SIND, 1809

The same fear of Napoleon's threat to invade India that led to the missions to Kābul and Lahore [I, 62, 65], led also to missions to Sind and Persia, and to a survey of the borders of Gujarāt.

The mission to Sind was led by Nicholas Hankey Smith[7], and after "a succession of tedious and trying negotiations" a treaty was concluded on 22nd August 1809[8].

The surveyors who accompanied this mission were William Maxfield of the Bombay Marine, and Charles Christie, commanding the escort [174]. The mission embarked at Bombay on April 27th and reached Karāchi on May 9th[9]. Disembarking on the 18th, they were detained till the 10th of June before they were allowed to proceed by river to Tatta, and thence by road to Hyderābād. They returned by land, "entering Cutch at Luckput Bundee and terminating at Mandavee". Maxfield's map was

made on the Stereographic projection on a very large scale to delineate that part of the River I had an opportunity of examining. ... The positions of the principal places are determined by celestial observations, and every precaution has been taken to render the map accurate. A detailed account of the Road Passes, Defiles, Fortifications, and faces of the Country accompanies the map, in which I have endeavoured to embrace every object

[1] Bo to CD. S & Pol. 29–10–11 (36). [2] 46 H 2, 3; *Bombay Courier*, 14–2–07. DDn. 278 (30). [3] Bo to CD. 21–12–11 (14). [4] Correspondence attached to map MRIO. 126 (21). [5] From Williams, 3–2–15; see also Petition, 10–6–17. [6] Bo MC. 4–10–15. [7] Bo CS. 1789; Resdt. Bushire, 1797, 1808. [8] Pottinger, II, chs. VIII to XII; Bo SC. 7–8–12 (20) [9] Sketch of Karāchi harbour, 1809; MRIO. 102 (289).

which can render it useful in a Military point of view. ...

The route by land from Tatta to Hyderabad was furnished me by Lt. Christie. ...

As the British Envoy embarked at Manduvie in the latter end of October for Bombay, I here conclude my detail of Scind. ... Every Town and village in that Country has two or three names[1].

In forwarding the map[2] to England, Government explain that Maxfield shows the soundings of the Indus ; as far as he had an opportunity of examining that river, the map is accompanied by a topographical memoir, with such observations as occurred. ... The possible attempt to invade the British possessions in India through the Territories of Scind, seems however scarcely to be apprehended, as the other and more Northerly known route has, from the days of Alexander, been pursued by every Invader as the open and accessible avenue into Hindoostan, leading also immediately to its most commanding and valuable parts[3].

KATHIAWAR & CUTCH, 1807–10

The peninsula of Kathiawar was broken up between a number of petty States, some of which were tributary to Baroda. On the outbreak of the Marātha War in 1803, some of the weaker of these applied for protection to the British Resident at Baroda, and during 1807–8 British and Baroda forces co-operated under Alexander Walker, the Resident, in putting down internal warfare, and settling disputes by agreements and treaties.

These operations gave opportunity for valuable surveys which in 1809 were compiled by Edward Hardy into a *Map of the Western Peninsula of Goojerat;*

The Map...is chiefly constructed from the Surveys of the Marches of Lieutenant Colonel Walker in the years 1807 and 1809, and the routes of Lieut. Hardy, who during the latter year Surveyed the Coast from Bujahna to Cambay. The position of some of the principal places on the Coast from Poseitra to Diu Head are laid down from the astronomical observations of Lieut. Maxfield. ...

Gopinant Point, Gogo, and Cambay are from the much esteemed Charts of Lieut. McCluer [I, 124–5]. The Route from Palleyad to Moorvie is from an accurate survey by Captain Greenwood. ...

The geography of this part of Guzerat was only known through medium of native information till the year 1807, when a small body of British Troops with train of Artillery under Col. Walker's command marched from Baroda on an expedition into the Interior. The routes were Surveyed with as much accuracy as possible, and every opportunity was taken to explore the Country round the different halting places. Captain Greenwood, Lieuts. Pierce, Hardy, severally carried on their observations, and the country...is described from the information obtained through their labours.

Another expedition proceeded into this Country in 1809, also under Col. Walker's command, which afforded an opportunity...to Survey the Country bordering on the great Runn at the Head of the Gulph of Cutch and the whole of the Eastern Coast of that Gulph which had never been visited by Europeans and was very imperfectly known[4].

Hardy's survey closed at Cambay on 11th December 1809.

In May 1809, whilst these surveys were going on, an attempt was made by James McMurdo to survey a line through the desert to Hyderābād, Malcolm writing from Bombay ;

It was my intention to have requested this Government to have allowed Lt. McMurdo, the C.O. of the Resident's Guard at Baroda, ... to have proceeded to Hyderabad by the way of Omercote[5], under the pretext of Carrying Dispatches to Mr. Smith [168], and to have requested that gentleman to obtain leave for Mr. McMurdo...to proceed by Karachi to Guadel, from whence he could have gone on to Muskat, or returned to Bombay, or have continued his journey through Mekran and Baloche to Persia as Circumstances suited[6].

McMurdo set out on his journey

from Pahi on the North-east Frontier of Kattywar. ... The country lying between Poseitra and Pubie having already been surveyed by Lieut. Hardy, my Journal commences at that

[1] B. Pol C. 9–1–10 (42) ; & 13–2–10 (16). [2] MRIO. 117 (1). [3] Bo to CD. (Pol) 31–1–10 (72). [4] Memoir sd. 29–1–10 ; Bo Sur. 15/1810 (77–9) ; DDn. 278 (23). [5] Umarkot, 40 G/14. [6] From Malcolm, 26–4–09; B Pol C. 8–7–09 (2).

place. From Sedla to Patri 6 Coss. 19th Dec. 1809. ... Jan. 1st 1810, Kuneije to Radhanpoor, ... Jan. 19th, Theraud[1].

He was not able to proceed further, the Resident reporting

the Dangers to which Lieutenant MacMurdo was exposed by his Journey to Therondo, and the Combination of the Petty Coolies of the Country to Plunder his Party. The increasing risks of continuing at Theranda, united to the Representation of the Chieftain of that Place of the Impossibility of advancing, prevailed on Lt. MacMurdo to return to Radhanpore. ...

Under all the Circumstances of difficulty which had occurred it did not appear advisable to the Commander in Chief that Lieut. MacMurdo should undertake a duty at the imminent Risk of his life, and without the means of protecting his person from the Hordes of Plunderers inhabiting the Tracts between Radhanpore and Scind. ...

On the return of Lieut. MacMurdo the obstacles which were encountered were equally perilous with those he had already experienced in reaching Theraud, and his safety may probably be solely attributed to...the Chieftain of that place, who engaged a gossayn immensely venerated by the barborous society of that Country to attend Lieut. MacMurdo...to Radhanpoor[2].

McMurdo got safely back with a sketch of his route. He was afterwards stationed for several years in Cutch, first at Māndvi[3], in command of a "considerable marine force [and] instructed to collect information respecting the Haunts of the Pirates". From 1816 till 1819 he was Collector at Morvi[4] and Resident of Cutch[5].

A survey of the Cutch coast made by Captain J. G. Vashon, of H.M.S. Fox, before 1806 has very neat little sketches of buildings along the coast[6].

NORTH-WEST GUJARĀT, 1809–10

To a call for geographical information about the western frontiers in view of possible invasion [7], Williams replied ;

The inlets to India to an Army intending the conquest of the British Territories are clearly through the Punjab and through the Southern part of Sind to Gujrat. ... All the rivers of the Punjab, beginning with that of Attock should, if possible, be now examined. ...

The actual nature of the desert should be satisfactorily ascertained. ... On this very interesting tract...the topographical part of Colonel Reynolds's undertaking would have been found most amply in detail, and it is a matter of great regret to me that untoward circumstances should have placed it entirely beyond his power to have transcribed so truly valuable a portion. ...

Our line of defence, if not advanced to the Indus, must be formed...between the head of the Gulf of Cutch and the hills commencing at Aboo Ghur[7], and receding North-East past Ajmer, upwards of 300 miles to the latitude of Agra. ... This fertile tract is...from 80 to 100 miles, and must be that on which any army formed at Bombay will have to oppose an enemy advancing from the westward. ... The city of Puttun[8]...stands in the middle, ... between Kurree (where we have now a captain's party) and the commencement of the Runn and deserts towards Sind. ...

The city of Pattun appears...to be the most proper point from which to set on foot our enquiries. ... We should there be able without difficulty or delay to obtain the most complete information of the Cutch country, the northern and western frontier of Gujrat, and the southern end of the desert. ... The surveys would be carried into Sind from the contiguous parts of Gujrat and Cutch ; a great portion of the Indus might be minutely examined by us, and perhaps some useful information obtained of the countries belonging to Persia on the west of that River.

I would take all my papers to Puttun and fix my office there for the time the map...would go on. ... Journies might also be made from Puttun...on the western side of the Hills to Jaysulmeer, Jhodepore, and even to Punessrampoora, the most western point of General Jones's marches in Hindustan [165–6][9].

[1] Rādhanpur, 41 M/9 ; Tharād, 40 P/11, narrative, B Pol C. 9–3–11 (142). [2] From Resdt. Baroda, 2 & 18–3–10 ; B Pol C. 2–5–10 & 9–3–11 (140). [3] 41 F/5. [4] 41 J/13. [5] Burnes (164–226). [6] Copied by J. C. Solomon, Engrs., probably as dmn. to CE. Bombay; MRIO. 104 (13–6). [7] Mount Abu, 45. D/10. [8] Pātan, 46 A/1. [9] to Bo. Govt. 14–12–08, DDn. 82 (83) ; B Pol C. 20–3–09 (20).

On hearing from Bengal that they would have to meet the cost of the survey, the Bombay Government asked whether they might

either altogether...withdraw, or...diminish the scale of this survey, as now perhaps less required, in reference to the improved state of affairs in Europe, and to the Peace with Turkey ; joined to the probable alienation of the Persians from the French [173]. ... Much...of the information now desired may be procured and sent out from the documents...of Colonel Reynolds' survey, which...[was] carried to England without the Colonel having been...able to leave the Copies in India[1] [283–4].

Bengal refused to accept responsibility ;

The proposed survey has reference to countries infinitely nearer to Bombay than to this Presidency ; the Officer appointed to execute it belongs to your Establishment, acts under your immediate orders, and is consequently responsible to you for the discharge of the duties assigned to him. ...

The responsibility of...authorizing the survey of the Countries between Persia and India will rest with this Government, and we have no doubt that the Hon'ble Court of Directors will highly applaud an undertaking of such manifest utility and importance[2].

Williams started the survey in March 1809 with four assistants, Nutt, Cruikshank, Byers, and Grindlay ;

The Survey was commenced at Dholka[3] on the 30th of March...and carried through Kurree...along the west bank of the Saubunmuttee River[4] to the latitude of Eeder, and thence Palhampore, which was the extremity of our progress to the north last season. ...

[After an expedition to Rhadanpur[5]] I effected a complete circuit back to Kurree before the setting in of the Monsoon. Besides the Geographical information, the experience of the disposition of the people towards my operations obtained on this Tour was extremely beneficial to me, and I had the further satisfaction to find, in laying down the Surveys, that they had been executed with accuracy, and that I had a fixed Basis for my future operations to the westward. ... I proceeded towards Puttun as soon as I thought the violence of the monsoon was over, but our operations were a good deal obstructed by the heavy rains which fell in the month of September. ...

In the meantime two of the Assistants were engaged on the Southern side of the Runn, which terminates the Gulf of Cutch, and I had arranged the plan of a minute Survey of the whole Peninsula of Guzerat to be executed by them. [Opposition from the Nawāb of Junāghar and the Rāja of Nāvānagar[6]]. I was, notwithstanding, extremely desirous of carrying on our investigation of the Country as far as where the Seas and the Runn meet at the head of the Gulf of Cutch and, as I conceived the Country to be perfectly friendly to us as far as Morevie[7], I desired Lt. Byers to extend his triangles as far as that place. ... He proceeded...as far to the West as Diu-ramingdra, which is 40 or 50 miles from Morevie, but he then received an order...to desist. ... In consequence...of the orders of the Acting Resident at Baroda, the Survey has not been extended further to the West than Durrungdra[8]. ...

I consider it...of importance to visit Marwar if possible, and, conceiving that the pretext of a Journey to Dehly would be more likely than any other to succeed, I wrote to the Jhodepoor Durbar that I intended proceeding from Palhanpoor to Dehly, but as the high road led through the territories of the Maharajah I waited his permission to go on.

Permission to enter Jodhpur was refused, so Williams ;

made an excursion among the Hills to the Northeast ; an invitation from the Rajpoot Rana of Daunta[9] afforded an opportunity of...making myself acquainted with the nature of this extensive range. The Rana, without any hesitation or the smallest apparent distrust, furnished me with guides and every assistance to the extent of his territory. ... I also traversed a considerable portion of the Dhamnaur District. ...

On quitting Palanpoor, I first...went to the northward as far as Dautwar on the Bunnass. The country thereabouts is wild and Jungly, and the coolies who inhabit it are quite uncontrouled in their habit of plundering ; they first opposed my crossing the River, but after coming to an explanation with the Thakories they complied with my wishes, and finally offered their Services. ... I took advantage of their offers, and got them to conduct me down the banks of the River to Deesa, and we passed several villages whose inhabitants would have been likely to obstruct our progress had we not been thus attended.

I was received at Deesa...with great friendliness and attention. ... I had the happiness to receive...a friendly invitation to visit Thumand, whither I proceeded without loss of time,

[1] B Pol C. 20–5–09 (19). [2] ib. (19). [3] 46 B/6. [4] Sābarmati R., 46 A, B. Pālanpur, 45 D/8. [5] 41 M/9. [6] Both conspicuous towards end of 1947. [7] 41 J/13. [8] Drāngadhra, 41 N/5. [9] 45 D/16.

escorted to the Deesa boundary by about 30 Horsemen. I was treated...with much hospitality; I remained there about a week and then proceeded by Sougong...and other places on the edge of the desert to Amysir, carrying on the survey the whole way with the utmost satisfactory accuracy, and at the same time gaining...the confidence and goodwill of all the people. ...

At Amysir the orders of Government reached me not to advance within the Cutch Frontier without the full assent of Futteh Mahomed Jemadar. ... I stayed at Amysir some days, and collected all the information that was obtainable of its vicinity to the West. I re-entered Guzerat through the Territory of the Juts, ... passed within a few coss of their capital Wantrye, but had no communication with them. ...

I joined this western survey to my frontier work at Puttan in the most uninterrupted and satisfactory manner. As soon as the relief of the Guard arrived at that City, I directed my course towards the Northward, and advanced as far among the mountains as the place where the Bunnass comes through them into Goojerat. I moved then to the Eastward as far as the neighbourhood of Eider, keeping as close as possible to the foot of the hills, and making occasional excursions among them. ... The line was continued near the Hills as far as the River Maye[1], and two of the Assistants are now employed in filling up the interior of the circuit in that quarter.

I have thus described the outline of what has been done; its extent is about 550 miles, and the construction...proves the operations to have been correctly performed. The interior of the circuit, excepting a small space between the Bunnass and the westernmost line has been traversed in all directions, and nothing...worthy of remark has...escaped us. ... The borders of the Peninsula, of Cutch, of Scind, and of Jhodepore have been touched upon, and I was restricted from entering any of these countries. ...

The time occupied in this work has been 14 months, 4 of which were rainy. One of my assistants was detained all the last season at Baroda, ... and ill health deprived me of the services of two others for several months.

I do not conceive, myself, that the Geographical and Topographical information that has been obtained is of more value than the favorable disposition created towards us among the Chiefs and people to the Westernward, with whom we were before such strangers. ...

My operations, as far as they have gone, will tend to confirm the value which has been set on Colonel Reynolds' great Map in England. The general accuracy and the great extent of information I found in it wherever I went, or to whatever quarter I directed my enquiries, filled me with admiration, and have taught me to place a higher estimation on Colonel Reynolds' work[2] [pl. 15].

The Resident strongly opposed the extension of these surveys into Kathiawar as successive expeditions...had put us in possession of as much Geographical information as the General National interests of our Empire could possibly require. Among other reasons which I urged to prevent the unnecessary attempt from his Department was the actual execution of the duty by Gentlemen every way qualified for the task, and who had the advantage of...the presence of the Detachment under my Command, ... which...could not be enjoyed by any Gentlemen from the Surveyor General's Department [171]. ...

Whatever may be the merits or the Abilities of the Gentlemen in the Surveyor General's Department, they were ignorant of the language and the Customs of that extraordinary Country, and not sufficiently known to me to enable me to put that confidence in their Judgement and Discretion which I could place in those officers who were acting under my own immediate orders[3].

He ridiculed the idea that there might be a favorable line of invasion through Gujarāt. After passing his letter to Williams for comment, the Bombay Government referred to Bengal for decision, asking whether, since

Colonel Walker...& Captain Williams (likewise a very respectable officer) have taken such opposite views of the expediency of making a more Minute Survey of the Peninsula of Guzerat, ... it be deemed necessary to prolong the field operations of the Survey for another year, ... the more especially as the Governor in Council expects to receive from England by the Ships of the next Season that minute Information, which, if Colonel Reynolds had not carried home with him without leaving copies in this Country, would...have precluded the expediency for the recurrence of a Second Survey of the Territories in question.

They called attention to the surveys of Colonel Walker's marches [169], and,

[1]Idar, 46 E/I; Mahi R. 46 E & F. [2]Report dated Cambay, 12–6–10; B Pol C. 25–8–10 (8). [3]ib (12), 19–1–10.

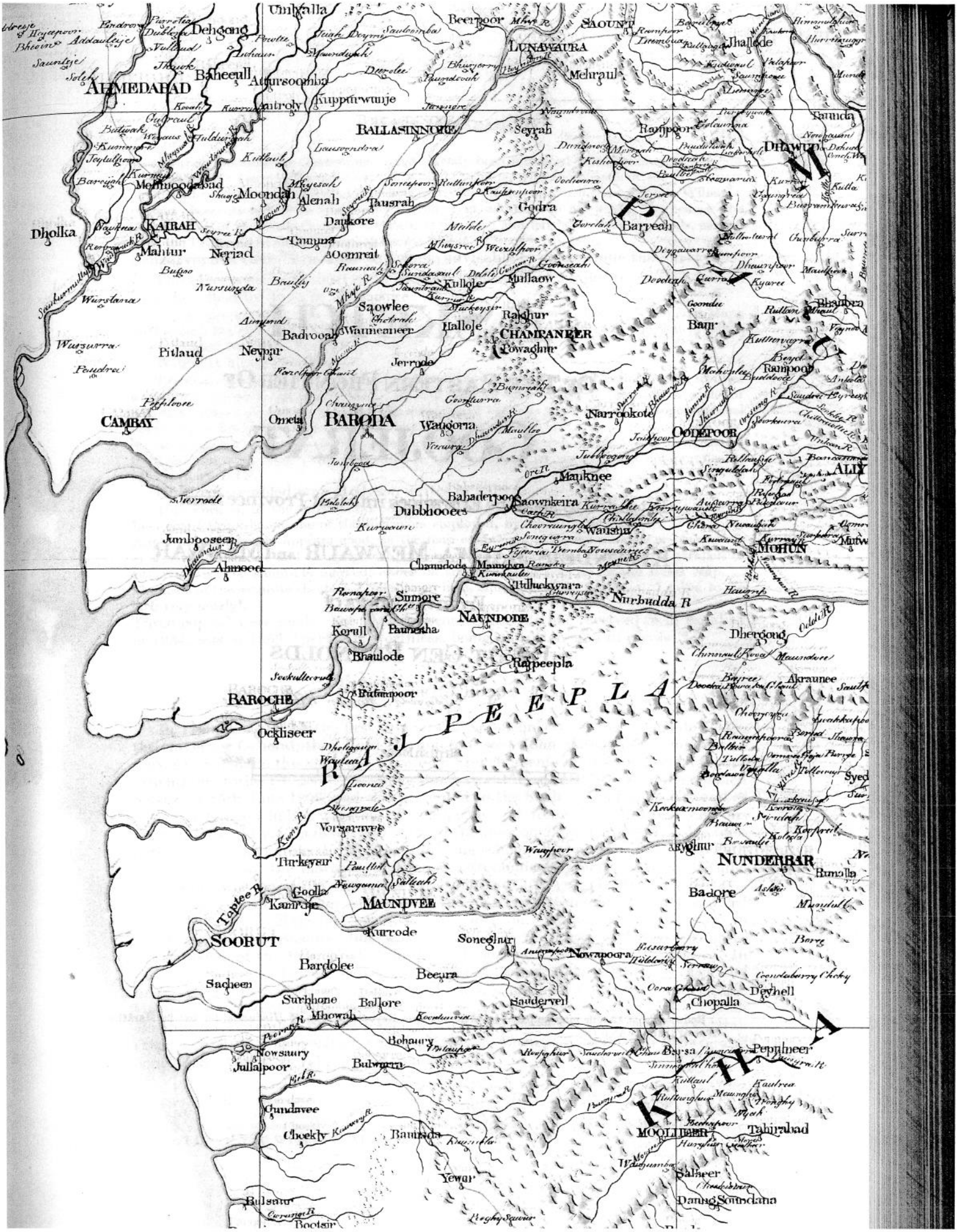

AHMEDABAD
Dehgong
Baheeull
Attursoomba
Kuppurwunje
Umbulla
Beerpoor
SAOUNT
LUNAWAURA
Melraul
Jhallode
BALLASINNORE
Seyrah
Ranpoor
Dhawud
Mohmoodabad
Moondah
Alenah
Tausrah
Godra
Barreah
Dholka
KAIRAH
Mahtur
Neriad
Daukore
Tunnuna
Doomreit
Kullole
Mullaow
Saowlee
Rajpur
Halloje
CHAMPANEER
Powaghur
Badrooah
Waumeaneer
Pitlaud
Neppur
Jerrode
Rampoor
Bam
Bhambra
CAMBAY
Ometa
BARODA
Waugora
Narrookote
CODEPOOR
Maulnee
Bahaderpoor
Saownkeira
Dubbhooees
Waushy
Jumbooseer
Ahmood
MOHUN
Chamudode
Mamchan
Hdluckynara
Nurbudda R.
Simore
NANDODE
Korull
Paumeha
Dhergong
Bhaulode
Rajpeepla
Akraunee
BAROCHE
Buttumpoor
Ockliseer
RAJPEEPLA
Vorgamvee
Tinkeyer
NUNDERBAR
Runalla
Badore
Goolia
Kamrije
MAUNDVEE
Tapee R.
Kurrode
Soneghur
SOORUT
Nowapoora
Bardolee
Beeura
Sacheen
Surbhone
Ballore
Saudervel
Chopalla
Devhell
Mhowah R.
Bohaury
Nowsaury
Jullalpoor
Bulwuna
Bansa
Peppulneer
Gundavee
Cheekly
Bamnida
MOOLHEER
Tahirabad
Yewur
Salheer
Bulsaur
Bootsar
Damun
Soundana
KUTCH

Plate 15

A SKETCH

OF THE EASTERN FRONTIER OF

GOOJERAT

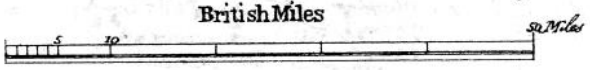
Intended to show the Entrances into that Province from

KHANDEIS MALWA MEYWAUR and MARWAR

From the Works of

LIEUT GEN REYNOLDS

(Signed) Monier Williams Capt
Late Surveyor General



Reduced from 12-mile map prepared by Williams from Reynolds's *Map of Hindustan*, for use in Marāṭha War of 1818 [284-5]

besides this, the Supreme Government have already been furnished with the route of the late Captain Seton's Journal through Cutch into Sind; together with those parts of the N.W. part of Guzerat more recently travelled over by Lieut. MacMurdo, to which tract Captain Williams' present observations will be found also to refer; in addition to all which, we possess the General Map of the whole Country of Cutch, as prepared and left by Colonel Reynolds, as well as of the Peninsula of Guzerat from the same officer.

Bengal replied that "it is upon the whole advisable to discontinue the Survey"[1].

The survey was contained in 43 sheets on the scale of 2 miles to an inch, which were described by Jopp in 1833 as

all original protractions, ... a most valuable collection of accurate surveys. The best Maps of Goojerat are compiled from them, and they are perhaps the only routes in that province which will not be required to be re-surveyed[2].

Williams himself writes;

The final arrangement and delineation of the surveys made on our North-Western frontier were not completed...till March 1813. On the 26th of that month a plan...on a scale of 2 British Miles to an inch on 7 sheets, with a volume of 366 folio pages containing topographical notes...and a descriptive index, ... were sent in to Government. ...

Although the surveys on the Northern and Western frontiers were ordered to be discontinued from the end of October 1810, my return to the Presidency of Bombay was not practicable till February 1811[3].

Of this assembled map Hodgson writes in 1822;

This work is, in the ornamental points of writing, printing, shading, etc., creditable to Lieutenant Cruikshank, one of the surveyors employed, by whom it was drawn. The Topographical construction appears good, as the map contains a sufficient number of places, but in a general scientific and Geographical point of view, it is deficient in having no parallels of either latitude or longitude marked, either on the separate sheets or on the Index Map. ... The scale of the separate sheets is 2 miles to an inch, and that of the Index, ... 7 miles to an inch very nearly[4].

Three copies[5] were made, but Waugh records that the one received from Bombay in 1834, was in 1850 "perfectly worthless, being all rotten and in pieces"[6].

MISSIONS TO PERSIA

In 1799, alarmed by the first rumours of Napoleon's intention to invade India, the Governor General, then Lord Mornington, sent John Malcolm on a mission to Persia to persuade the Shah not to receive French agents nor admit French troops into his territories [I, 286]. Leaving Bombay at the end of 1799, Malcolm reached Shīrāz on 15th June 1800, and was presented to the Shah at Tehrān on November 16th. After concluding treaties of commerce and friendship, Malcolm and his mission returned via Baghdād and reached Bombay on 22nd April 1801[7]. He took with him two boys from the Madras surveying school, Webbe and Pope, who kept up surveys of all the marches, and made astronomical observations for latitude. Their work was mapped at the observatory in 1807 [I, 375; II, 280][8].

In 1808 arose another scare and the Governor General, this time Lord Minto, deputed Malcolm on a second mission. Sailing from Bombay in April he reached Bushire, but was not allowed to proceed further owing to the influence of the French at Tehrān, and returned to India in August[9]. In the meantime the British Government had sent out a mission from England under Harford Jones[10], who reached Bombay a week after Malcolm had sailed. Unaware of Malcolm's discomfiture and return to Calcutta, Jones sailed from Bombay on September 12th and, the French having been dismissed from the Persian Court [171], he was received with cordiality as Envoy of the British Crown, and concluded a treaty at Tehrān in March 1809[11].

[1] Bo Pol C. 25–8–10 (7–13). [2] DDn. 278 (24). [3] From Williams, 3–2–15; Bo MC. 8–5–15. [4] DDn. 198 (29), 9–3–22. [5] One copy in good condition MRIO. 125 (1–7). [6] *PR.* (40); DDn. 542 (166), 20–10–50. [7] Kaye, I (120–54); Davis (5). [8] Map, MRIO. 93 (33); MPC. 28–2–07. [9] Kaye, I (240). [10] Bo CS.; had spent some years at Baghdād as Company's representative; later took name of Brydges. [11] Kaye, I (400 *et seq*); Brydges (17–9).

In the meantime Lord Minto determined to send Malcolm once again to represent the interests of the East India Company, and to collect as much information as possible about the geography of Persia and its frontiers.

By the end of 1808 Malcolm collected a considerable expeditionary force at Bombay, with several officers capable of survey and exploration, including some from the Travancore survey and others from the Military Institution, who were all kept for several months in Bombay compiling maps [131]. The expedition was, however, countermanded in April 1809, and the surveyors dispersed[1].

Nathaniel Grant was the only officer to get overseas at this period ; sailing from Bombay on 18th January 1809, he landed on the south coast of Makrān and spent four months exploring there[2]. He was "directed to purchase some horses as a Pretext for his Journey; these may (if sent to Bombay) either be disposed of, or made over, if fit for the service, to the Cavalry", but he reported that "the horses are miserable animals, and I have not seen one above 13½ hands; Meer Sobhan sends you 2 Greyhounds; they look good, but I am a bad judge of these things"[3].

Malcolm was recalled to help in settling the Madras mutiny [313–4], but by the end of 1809 he assembled his mission once again. He deputed some of his officers to travel through Baluchistān, and others by way of Irāq, and sailed with the rest from Bombay on 10th January 1810. He was cordially welcomed as an old friend by the Shāh on June 23rd[4], but had little official standing, and when news arrived that an ambassador from England, Sir Gore Ouseley, was coming to relieve Harford Jones, he discreetly withdrew, and returned to Bombay early in 1811[5]. His mission, however, had been a great success in promoting good feeling and collecting geographical information, and his officers had stirring tales to tell.

Christie and Pottinger sailed from Bombay on 2nd January 1810, landed at Sonmiāni 50 miles north-west of Karāchi[6], and then travelled disguised as horse dealers through Baluchistān to Persia. Keeping together as far as Nushki, they separated through Seistān and Khorāsān, and joined Malcolm at Shīrāz in August. In submitting their memoirs and maps, Malcolm writes ;

> The Memoir of Lieutenant Christie, who was entrusted with the execution of this Service and to whose spirit, firmness, and Judgement, I must chiefly attribute its success, is not so full as that of Lieutenant Pottinger, who acted under his orders. ... The former was, immediately on his return, detached to Tabreez, while the latter who came with me to India, had leisure to digest the materials[7].

Pottinger's account was published in 1816 as *Travels in Beloochistan and Sinde, accompanied by a Geographical and Historical account of those Countries*, and he writes of his map ;

> The routes of Captains Grant and Christie, as well as my own, are laid down from original papers, except that the positions at which they commenced and terminated having been, before or since, ascertained by means of observations, I have adopted their actual latitudes and longitudes. The native routes have been collected and compared with the most scrupulous care.
>
> Each Province was...exclusively the object of my inquiry, and when I had satisfied myself on it, or was unable to obtain further information, I proceeded to another. ... Of some of them I have projected six or seven different maps, and the method I finally resorted to... was to explain the points of the compass to natives of particular districts, shew them any stationary town or village, and desire to be informed where other towns of the same district lay.
>
> Whenever two of my informants disagreed, and I had an opportunity of doing so, I confronted them, and if they could not demonstrate on which part the error lay, I suspended my judgement until I could find other people. ... On some important places I have had the combined testimony of upwards of one hundred natives, the medium of which I have adhered to, and I have shewn my map to a man who had been in the habit of travelling in Sinde and the

[1] BSC. 10–4–09 (27) ; MMC. 21–3–09 & DDn. 63 (191), 8–5–09. [2] Journal, MRIO. M 443. [3] BSC. 20–5–09 (50). [4] Kaye, II (8–50). [5] VM. exbt. 176. Court of Fath Ali, Shah of Persia, contains portraits of Ouseley, Jones, and Malcolm. [6] Journals, B Pol C. 28–6–11 (8, 9). [7] ib. (7) Routes, MRIO. 111 (4–7) ; 116 (60–62) ; DDn. 278 (226).

province of Kutch Gundava who, after he had had the situation of Hyderabad...explained to him, pointed out every place that was mentioned with astonishing precision.

The River Indus has engaged my most particular attention, and I venture to pronounce it to be altogether as free from error as anything of the kind can possibly be without actual survey. A portion of it has been ascertained by the latter method by Captain Maxfield [168]...and as I found my native accounts to correspond with what he had fixed, and I had myself seen, it was a satisfactory testimony towards the general reliance to be placed on it all. ...

I was unprovided during my tour with a barometer, or other instruments, that might have assisted me in finding out the perpendicular height of Kelat as the most elevated spot of the Brahooick mountains[1].

From these explorations, whilst Grant reported that it might be possible for an army to march to India along the Makrān coast, Christie and Pottinger confirmed earlier reports that the Helmand Desert was a complete bar to any more northerly route through Baluchistān.

Before leaving Bombay Malcolm deputed Grant to Irāq ;

The manner in which you last year performed an arduous and dangerous Journey through Mekran, makes me anxious that the public should receive further benefit from your exertion in this difficult but valuable line of service. I wish you to proceed to Busserah in the H. C. Cruizer, and from thence to Bagdad, ... (and thence to join my camp at Ispahan). You will...employ Lieutenant Fotheringham of the Madras Cavalry...in whatever way you may judge most conducive to the service[2].

Grant and Fotheringham arrived at Baghdād on March 17th, and on their way through the hills towards Isfahān were plundered and murdered by Kurd tribesmen. Frederick was sent to investigate the crime ;

I was appointed at Shiraz in May a Supernumerary assistant in consequence of Captain Grant's death, and sent expressly to investigate the truth and circumstance of that melancholy event ; and at the same time to afford information relative to the state of that quarter of the country. ...

I left Shiraz...and performed the journey to Isfahan in five days, riding 58 miles the first stage. From thence to Kermanshah I went in disguise and, after remaining there three weeks, I met the Mission, having in the meantime passed through a very unfrequented country. ... From this place I recommenced my journey, ... returning partly by a different route to Isfahan, and finally rejoined in October at Bushire. ... The Map or Route which I subsequently presented...was neither ordered nor expected from me[3].

Whilst Snodgrass surveyed the route "from Bushire to Shiraz by the way of Ferozeābād, ... the only road from the sea coast to Shiraz that it is possible to make practicable for artillery"[4], Macdonald and Monteith ran a survey from Bushire to Basra, and from thence to Shīrāz,

a survey of near a thousand miles through a tract of country hitherto unknown to Europeans. The Hazards to which these officers have been exposed have arisen solely from the unsettled state of the country ; from the officers of the Persian Government they have invariably experienced hospitality, kindness, and protection[5].

This expedition took three months but, writes Malcolm,

during upwards of four more that he [Macdonald] remained with me, he was indefatigably employed in writing his excellent Memoir upon the general Geography of Persia, and the great aid I have derived from that valuable document in constructing the large Map upon which I am now employed [calls for recognition][6].

Besides these military officers Malcolm had the services of William Webbe[7], who probably surveyed the actual marches of the mission headquarters in Persia. On return Webbe was kept at Bombay till the end of 1811 [156–7] working on a great Map of Persia and countries lying between the Araxes, Tigris, and Indus. Constructed from the surveys which were taken, and the information collected, during the mission of Brigadier Malcolm to Persia in 1810. ... Scale 1 inch to 23 miles[8].

"This map", writes Malcolm,

has been formed with that minute attention which Geographical works so particularly require, and I may venture to affirm there is not a village laid down in it, the position of which has

[1] Pottinger (257). [2] Alexander Fotheringham (1787–1810) ; Mad. Cav. Lieut. 31–7–04. B Pol C. 7–7–10 (80). [3] *Route from Ispahan by Kirmanshah to Muraga, and return by Hamadan* ; MRIO. 93 (36) ; B Pol C. 28–8–12 (8). [4] MRIO. 93 (35) ; B Pol C. 28–6–11 (7). [5] ib. 7–7–10 (77). [6] ib. 15–11–11 (1). [7] M Rev Bd 14–9–08. [8] MRIO. 93 (14).

not been sufficiently ascertained to prevent the possibility of any mistake of magnitude. I have thought it better that a great part of this Map should be left blank than to mislead by laying down any one Town, River, or Mountain, of the existence and position of which there was not satisfactory information.

This Map has been constructed by Mr. Webbe, an Assistant Surveyor of the Madras Establishment, by whom the enclosed Memoir is written. It is but justice to this Meritorious and able young man, and to that Public Seminary in which he was educated [I, 283; II, 210], to declare that the Sole Merit of the executive part of this work belongs to him; he has, it is true, acted under my general direction and Superintendence, and I have translated a great number of Routes from Persian Works of authority to make the Map more complete, but he has neither received aid from me, or from any one else in constructing the Map, or in writing the Memoir[1].

The Memoir explains that,

In constructing the Map, great attention was paid in laying down correctly the latitude and longitude of such of the principal points of the Western parts of Persia as were ascertained by astronomical observations, viz., Tehran, Bushire, Sennah, Isfahan, Sherauz, Bagdad. ... From these were laid down Tabreez, Muragha, Kermanshah, Sooltamah, ... all of which were fixed by latitudes and by cross routes travelled by officers attached to the Mission. Several villages in these routes were also corrected by latitudes observed[2].

When Harford Jones embarked at Bombay [173], he was accompanied by James Sutherland, at that time senior assistant to the Surveyor General. Amongst the surveys he carried out during more than two years in Persia was one of considerable length along the Perso-Russian frontier towards the Caspian Sea[3]. His *Map of Western Persia* was published as a supplement to Harford Jones' *Dynasty of the Kajars*[4].

[1] B Pol C. 25–1–12 (9). [2] ib. (10). See map in Malcolm's great work *The History of Persia*. qto. 1815; also MRIO. 93 (14). [3] Brydges (351). [4] Harford Jones (cxcii).

CHAPTER XIII

REVENUE SURVEYS

BENGAL:— The Lower Provinces — The Upper Provinces — MADRAS:—Thomas Munro — District Settlements — Assistant Revenue Surveyors — BOMBAY:—Bombay & Salsette Islands — Broach.

AN account has already been given of the introduction, in 1793, of the permanent settlement of Bengal, and it has been shewn how fresh assessments and surveys were still required from time to time, more especially to meet the reclamation of waste lands [7, 14]. Such reclamation was being carried out over wide areas on the fringes of the Sundarbans, and it was to give Government some idea of what was happening that early in 1811 William Morrieson was appointed to survey the Sundarbans [14–15].

Since the date of the Permanent Settlement a large extent of Sundarban land had been reclaimed, which was...paying nothing, ... but from which Government was entitled to revenue. ... The survey...which Lieutenant Morrieson was then carrying out...would shew what lands had been reclaimed, and what still remained forest[1].

In 1814 Government noted that

some time past an Engineer officer was deputed to survey those parts of the Sunderbunds which had of late years been brought into cultivation, and...he has been engaged in the performance of that duty during the last and present season. It was fully intended that as soon as sufficient progress had been made in the survey, proper measures should be adopted in the Revenue Department for the Assessment of such of the lands...as were not included in the settlement already made with the Zemindars. ... It merits consideration whether the assessment of these lands, and those which have been already surveyed by the above-mentioned officer, should not now be undertaken on a large scale[2].

The Decision of Government [writes Partiger] was passed on 11th June 1814. ... Mr. D. Scott...was...directed to settle the lands reclaimed in that district, beginning at the south, and working northwards. ... Scott's duties, it seems, were confined to the country west of the river Isamati, and he was furnished with a copy of Lt. Morrieson's map[3].

Early in 1815 a letter was received from the Directors, laying it down

as a general principle, that lands not included the boundaries of permanently-settled estates were the property of Government, and liable to such assessment as the Government might think fit to impose. Regarding the Sundarbans, they thought that, although a survey had been begun there, a more detailed measurement by the agency of natives would be requisite[4].

This detailed survey was put in hand during 1815, and will be described in a later volume.

The survey of the neighbourhood of Sāgar Island which Blane carried out during 1813–4 was initiated by the Revenue Board, who reported that they had received applications for large tracts of land and wanted a map shewing areas computed in *bigahs*. The Surveyor General drew attention to Blane's survey of 1811 [15–6], which however did not "penetrate into the Country, but only to the borders of the Jungle, with the western bank of Channel Creek", and the Board replied that,

at the time we submitted the proposition...we were impressed with the idea that the Island of Sagor was confined to a small spot at the Southern extremity of the Hooghly River and Channel Creek. On reference however to the Survey lately made by Lieutenant Blane, we find that the Island of Sagor extends from the northern entrance of Channel Creek to the Sea.

They proposed

[1] Partiger (6). [2] DDn. 129 (158), 5–3–14. [3] David Scott, jr. (1790–1856), BOS 1807; son of Capt. Wm. Scott, RN.; Pargiter (7). [4] ib. (9–10).

that the Lands situated between the Barratulla and Subtermooke Rivers, and bounded to the North by a nulla...about 16 miles from the Sea, ... be tendered to the public. ... We would propose that the spot be surveyed[1],

which was accordingly done by Blane [16].

In similar manner, Cheape's survey of Chittagong [19] originated in 1814 from a revenue demand ;

His Excellency in Council has long been impressed with the expediency of bringing such of the Lands as have of late years been reduced to cultivation in the District of Chittagong, and are not included in the Permanent Settlement, upon the public assessment. ...

Measures should be taken for Surveying the whole of the Cultivated tracts of the District of Chittagong which are not included in former Surveys as soon after the expiration of the present rainy season as possible. An Engineer officer will accordingly be appointed in due time with one or more assistants for the performance of that duty.

The Vice President in Council presumes that an accurate Survey made by professional persons will materially facilitate the duty of the revenue officers in subjecting the Lands in question...to the public assessment[2].

THE UPPER PROVINCES

The cession to the Company of several districts of Oudh and Rohilkhand in 1801 [26], and of Cuttack in 1803 [23], led to a lengthy discussion on the extension of the permanent settlement to these provinces[3] [7].

In our Revenue Letter [wrote the Directors] dated 27th February 1810 (par. 44 to 47), we communicated to you our opinion that it would be premature to introduce the permanent settlement into the Upper Provinces at so early a period of our connexion with them, and in so imperfect a stage of our acquaintance with their resources. In proportion as our knowledge of Cuttack is more defective than of these provinces, our conviction of the unseasonableness of hastily attempting such a measure in that Zillah is still more decided.

Before undertaking so arduous a task as that of irrevocably settling in perpetuity the lands of a province, ... we have always considered a patient and laborious scrutiny of individual rights, a careful investigation of local peculiarities, together with a minute and detailed survey of the extent, cultivation, and productive powers of the territory, as indispensable. ...

The last (viz. a survey of the lands), though it be attended with considerable trouble and expense, is necessary to a fair and equal assessment, while the discoveries of fraudulent concealments or improper alienations...have in general, we believe, much more than compensated for the additional charge incurred. ... In the management of the Conquered and Ceded Territories which have been annexed to the two subordinate Presidencies, this course has been successfully pursued [180–2, 188–9]. ...

If, in settling the lands of the Bengal provinces, a particular survey was not judged to be necessary, it was because, from long possession, we supposed ourselves (perhaps too hastily) [I, 140–1] to be thoroughly acquainted with their resources[4].

Again in a later letter ;

The object of the present dispatch is to caution you, in the most pointed manner, against pledging us to the extension of the Bengal fixed assessment to our newly acquired territories. ... It is not...without anxiety that we have learned from your late dispatches that a triennial lease has been concluded in the Upper Provinces, which expires, we believe, in the course of April 1812, whereby the assessment in the third year of the lease has been declared by you to be permanent, ... which we are not by any means prepared to satisfy. ...

You are directed to continue to administer the revenues of these provinces under a renewed lease for a term not exceeding five years[5].

The Company had been in possession of Bengal for nearly thirty years before the Government fixed limits to its demands upon the land ; it was not, therefore, without surprise that we were informed...of your having deputed two Commissioners, for the purpose of extending that settlement to a vast extent of country which was acquired, by treaty and conquest, only five years before[6].

The Bengal Government replied that revenue assessments were not being fixed merely by a few years experience, but from

[1] BPC. 26–2–13 (7). [2] BMC. 15–7–14 (107). [3] *EIC. Sel.* I. [4] CD to B. (Rev), 1–2–11 (19–22). [5] ib., 27–11–11 (2–4). [6] ib., 15–1–12 (66).

accounts deposited in the offices of the Collectors themselves ; ... the Zemindarry accounts ; and the accounts of the Canongoes and Putwarries[1]. The Zemindarry dufter and the Serishtah of the Canongoes and Putwarries are not contrivances and institutions of the British Government, but of the Governments which preceded us, and existed at least in as complete a form under the latter as under our administration. ... Generally speaking there are absolutely no other documents which [can] be applied to the object in view.

It may be urged, perhaps, that the circumstances here noticed furnish a strong argument for those local surveys and valuations to which your Honorable Court has...averted, and which are stated to have been attended with such beneficial effects in other parts of India. But we know nothing that we should more strongly deprecate than the undertaking of such Surveys and valuations in the territories immediately dependant on this Presidency. ...

Possessing only a general knowledge of the measures adopted...in the Presidencies of Fort St. George and Bombay, and of the effect of those measures, we are necessarily precluded from offering any opinion ; ... but the experience obtained on the subject in Bengal would by no means warrant us in recommending that a similar course should be observed in...this Presidency.

In former times recourse was not unfrequently had to this expedient, but the chicanery and corruption practised by the large body of native officers necessarily employed ; ... the exactions and injustice which the Zemindars and others were consequently exposed, and the heavy expense with which all such Surveys were attended, gradually induced succeeding Governments to abandon the plan of fixing the public assessment by an actual measurement and computation of the produce of the lands of each individual [I, 137–41].

The practice has long been entirely discontinued, and we are satisfied that the most experienced and capable of the Revenue officers would deem the revival of it an evil, burthensome and oppressive to the people, and unproductive of any substantial benefit to the pecuniary interests of the State. ...

The village accounts above noticed should be received with circumspection, but when such precautions have been duly observed, they have been found fully adequate. ... At all events, much greater confidence can be reposed in them, because they are not easily falsified or fabricated, than can be done in the accounts of local surveys and Valuations made almost exclusively by the Agency of Native Officers not holding any permanent appointments under Government[2].

The Directors refused to accept these arguments ;

By the survey and other statistical reports which have been drawn up from time to time by some of the ablest of our revenue servants in the Madras Establishment, we have been put in possession of a most valuable mass of information concerning the actual condition and probable resources of the territories dependent on the presidency of Fort St. George [I, 145 ; II, 182–4]. ... Certain it is that our acquaintance with the provinces under your presidency is much more limited. One material advantage derivable from a detailed measurement of the lands of a district is that it operates as a most salutory check upon the accounts, for the most part fallacious, which are kept by the native revenue officers of the extent and productiveness of the soil in cultivation, and which, if taken as the sole basis of an assessment, would render it always inadequate, and often unequal. ...

It is from a want of that information which a regular revenue survey can alone afford, when succeeded by a proper registry and inspection of village cultivation, that those serious affrays can be effectually put an end to, which are constantly arising in lands already in cultivation respecting disputed boundaries of estates and crops. ... We conceive that the dispute, in the first instance, generally originated from an undefined state of property with respect to limits.

After quoting accounts of troubles caused by faulty records, they continue ;

That surveys of the land are attended with considerable expense is unquestionable, if they be duly performed, but if the benefits resulting from them be far more considerable, and no less certain, ... this objection falls to the ground. ... We have satisfactory evidence that in the Peninsula they have amply repaid, as well by increased revenue as in a variety of other ways, the charges attendant upon them.

The conviction entertained by the Bombay Government of the expediency of surveys has prompted them to adopt that method of investigating the landed rights and tenures in the recently acquired territories on that side of India [188–9][3].

Whilst these discussions were proceeding, short-term assessments of revenue

[1] *Kānungo* ; revenue accountant ; *patwāri*, keeper of village records. [2] B to CD. (Rev), 17–7–13 (6–10). [3] CD to B. (Rev), 6–1–15 (22, 24, 29).

were made in various parts of the Upper Provinces. In 1806 Government approved that, in the area of Delhi [58][1], "settlement should be made with the occupants of the several villages, as preferable to letting the lands in farm", and the following year the Resident reported ;

That we are not yet thoroughly acquainted with the resources of the country may, I think, be attributed to the following causes— ...

To the obstinacy and perverseness of many of the zumeendars. Of lands belonging he persons of this description, the settlement could not be made with accuracy from their resisting a measurement of the cultivated part of their estates which, together with the total want of authentic village records, ... greatly tended to perplex the business— ...

To the...distrust which to a certain degree still prevails among the landholders, and which induced several to abscond at the time when their presence was required for the formation of the settlement[2].

The settlement was carried out by Charles Metcalfe [62 n.5] during 1807–8 and he notes that

the ascertaining the produce and value of the land must, of course, be the foundation of every revenue settlement, ... either by...being guided by the accounts and records, if authentic, of previous years, or...by measuring the cultivated portion of each village, and ascertaining the articles of produce.

Upon the present occasion, ... from the want of regular documents, ... it would be desirable to have recourse to the *latter* of these modes. ... I fear however...its adoption must be postponed.

This is usually carried into effect by deputing into each village an *aumeen*, two or more measurers (i.e. *jereeb kushes*[3]) and a *moharir* on the part of the *canoongo*, ... together with the *putwarree* of the village, taking the precaution to affix to the pole, rope, or such other instrument of measurement as may be in local use, the seal of the Cazee and Tehseeldar[4].

In 1809 the Commissioners of the Ceded and Conquered Provinces [26, 28] wrote from Farrukhābād recommending

accurate surveys of the several pergunnahs ; ... the expense incident to it would be abundantly compensated in the actual pecuniary benefit which would ultimately result to Government. [The survey would bring to light rent-free tenures, and waste lands recently reclaimed, of which there was no exact knowledge]. The beneficial results to the Military and Police Departments, though not within our cognizance, will not escape the penetration of Government. ...

We presume that if there should not be on the establishment of Engineers any officers who could be spared, ... other persons competent to the discharge might be readily found, and that the extra expense to be incurred...would not be great, as the boundaries of pergunnahs only, and not of villages, would be the object to be ascertained, with an exact measurement of all the lands contained in such pergunnahs. We apprehend no difficulty...from the disputes... respecting village limits, and the Canoongoes might be directed to attend and point out the extent of the Pergunnahs, which we believe continue, with little alteration, the same as they stood in the time of Akbar the first [I, 133][5].

It was not however before 1814 that Alexander Gerard started the survey of Sāhāranpur District [7, 36], being appointed

to survey all Pergunnahs & Estates, the assessment of which has not yet been fixed in perpetuity ; with the official designation of Surveyor to the Board of Commissioners[6].

He commenced work in January 1814[7], but was recalled to military duty twelve months later to play his part in the Nepāl War.

MADRAS :—THOMAS MUNRO

We have already described the settlement survey carried out by Alexander Read in Salem and Bāramahāl between 1793 and 1798 [I, 144–5], and we now come to the work of his pupil Thomas Munro, who applied Read's *ryotwāri* system to the Ceded Districts, and worked out a code of regulations which, with

[1] *Delhi Records.* [2] ib. (2 *et seq*). [3] chainmen. [4] ib. (16), 21–12–07. [5] DDn. 82 (221–4), 31–8–09. [6] BGO. 21–10–14. [7] Fdbk. MRIO. M. 381.

little modification, governed the revenue operations of Madras and Bombay for the next sixty years [8].

After the fall of Tipu, Munro was appointed the first Collector of Kanara [158] and during his year there made a settlement with the landholders, estate by estate, based on vernacular records[1]. He also made an experimental survey of one village[2] [96].

In October 1800 he was transferred to the Ceded Districts, an enormous area covering the present districts of Bellary, Kurnool, Anantapur, and Cuddapah [152]. The country was in a disturbed unsettled state, and the *poligārs*, or petty chiefs had long been their own masters under the rule of Mysore or the Nizām. Nothing daunted, Munro proceeded to institute a survey and assessment of the country, aided by four assistant collectors ;

There was no private property in land in the Ceded Districts, as in Canara. ... The land had always been regarded as the property of the State. Accurate records of ancient assessments, such as in Canara, had no existence, ... though records appear to have been tolerably complete from the time of Hyder Ali.

From the information thus available Munro proceeded to institute a survey and assessment of the country. The system of revenue introduced was ryotwari assessment upon each separate field, instead of on the entire holding as in Canara, and it was based upon a detailed measurement of the land, & classification of the productive capacities of the various soils. The two processes of Survey and Assessment, which were conducted separately, were carried out very much upon the same principles as those which regulated the surveys & assessments made in India in more modern times, although they were probably less accurate, owing to the inferior nature of the native agency which in those days was available.

The survey was commenced in 1802 and finished in 1806, the most complete that had yet been made in any Indian Province. ...

Munro's contention was that where large landholders did not already exist, it was not wise to create them by an artificial process. ... He contended that in the Ceded Districts, and in the greater part of Southern and Western India, the ancient land tenure of the country was pure and simple ryotwar[3].

In reporting the completion of his task, Munro writes[4] ;

It was begun in June 1802 by four Gomashtas of my Cutcherry, who were at that time the only persons in the Ceded Districts who understood land measuring. It proceeded very slowly at first from the want of hands but, several of the Inhabitants being instructed every month, the number of Surveyors by the end of the year amounted to fifty, and was in the course of the following one augmented to a hundred. ...

The average revenue has been about sixteen lacs of Pagodas, which at four per cent gives 64,000 Pagodas. But the Survey has already cost 80,000 Pagodas, and will cost about 3,000 more. This increase is occasioned by its having occupied nearly five years instead of four, owing to my attention having been partly diverted from it to the business of supplies while the Army was in the Field [57, 102], and to its having been necessary to survey a second time a great part of the lands on the banks of the rivers, in order to ascertain how much of them had been carried away by the inundation in October 1804.

The Surveyors were at first formed into Parties of six, but afterwards of ten, to each of which a Head Surveyor or Inspector was appointed. With the exception of hills and rocks, all land of whatever kind was measured ; all roads, sites of towns and villages, beds of tanks and rivers, wastes and jungles, were included in the Survey. ...

The Surveyors used everywhere the same standard measure, a chain of thirty-three feet, forty of which made an acre. They were paid by the Acre at such a rate as it was supposed would enable them with diligence to earn about six Pagodas monthly. They were encouraged to be expeditious by the hope of gain, and deterred at the same time from being inaccurate through haste by the fear of dismission, for no false measurement beyond ten per cent in dry land, and five per cent in wet, whether proceeding from negligence, from haste, or design, was ever excused, and frequent instances of loss of employment on this account that occurred during the early part of the Survey, soon rendered the Surveyors so cautious that their measurement was afterwards in general sufficiently correct. ...

The Head Surveyors, or Inspectors, examined the measurements of the Surveyors placed under their charge. They were paid by the month. To have paid them by the Acre would

[1] Arbuthnot, I (lxxiii). [2] 48 K/11 ; MRC. 20–5–00. [3] Arbuthnot, I (xciii, ci). [4] Report, 26–7–07 ; M. Rev Bd. 234 (18275).

have defeated the end of their appointment, by preventing them from examining carefully and deliberately the operations of the Under Surveyors. But to guard against remissness and to leave them at the same time sufficient leisure for investigation, they were required to measure monthly one-tenth of the quantity of land fixed for a Surveyor. ...

The whole of the Inspectors were frequently removed from one Party to another, because by remaining too long with one Party they were apt to entertain partialities and enemies, and to pass over the false measurements of some Surveyors, while they exaggerated the trifling errors of others; and for these causes many Inspectors were at different times dismissed.

Of 38 rules laid down for the guidance of Surveyors, two provided that;

No. 28. To prevent the survey from being retarded from indolence, you must measure daily, whether sirkar or enam[1] land, as follows;

Dry:	If cultivated	5,000	Goontas or chains
	If...uncultivated land, divided into fields	6,500	,,
	or if...undivided waste or common ...	25,000	,,
Wet:	If cultivated	1,500	,,
	If uncultivated	2,500	,,

No. 38. You will pay the bazar price for all articles received in the village. If you do not pay, or if you receive batta, you will be dismissed.

Of 25 rules laid down for "Examiners of the Survey" two read;

No. 13. If any Rayat complains that the measurement of his field is not fair, you will measure it again.

No. 21. You are not to try the measurement of a part of the Surveyors in one Month, and that of the rest in another, but you are in each month to try the measurement of all the Surveyors.

More than eighty years later Munro's work was thus appreciated;

It is astonishing how Munro was able, with such rapidity to organize an establishment, and carry through a work which was not only new, but detrimental to the interests of the village headmen, whose false accounts and concealments of cultivation were thus brought to light. ... It is on the whole wonderfully correct, and though it never underwent the revision which Munro intended to apply to it, it is to this day a safe guide in most village disputes[2].

Not only was Munro's system extended to other Madras districts, but in 1813 a full account was passed to the Bengal Government, who were at that time wavering between the merits of the permanent settlement and some form of *ryotwāri* settlement for their Upper Provinces [8, 178–9][3].

Munro left India in 1807, and on his return in 1814 was concerned in the reform of the civil administration. When, however, he became Governor of Madras in June 1820, he took a special interest in revenue administration, and has left important minutes on the subject of settlements and surveys[4].

DISTRICT SETTLEMENTS, MADRAS

There was no regular policy for the assessment of revenue in the various districts of the Madras Presidency; each was dealt with by the Board of Revenue according to local conditions, which included past history and the capacity of the Collector. It was laid down, however, in 1805, as a general principle, "that the Collectors of Revenue should be directed to proceed with all possible dispatch in the survey of their respective districts"[5].

These settlement surveys were to be entirely distinct from those more general district surveys entrusted to the assistant revenue surveyors [139–51], and their general untrustworthiness was sensed by Bentinck, who wrote in 1804, when advocating the establishment of the Military Institution [124, 314–5];

How great would the advantage have been in forming either the annual or permanent settlement of our Revenues if the districts had been laid down by men of science, precluding the necessity of trusting to the surveys of natives, equally liable to error from want of honesty and from want of knowledge[6].

[1] rent-free grant. [2] Gribble (117–22). [3] CD to B. 20–1–13 (32). [4] e.g. Minute of 30–1–27, Arbuthnot (281). [5] MRC. 9–8–05. [6] MMC. 29–9–04.

In the Jagīr[1] and the Northern Circārs alone was permanent settlement introduced ; in most other districts a survey, or *peimash*, by native staff was completed before 1808, and formed the basis of all periodic assessments during the next fifty years.

Of Tinnevelly it was recorded in 1803 that

the errors which have been already discovered, ... in consequence of the survey commenced by Mr. Lushington, sufficiently demonstrate the expediency of that undertaking, and the advantages which may be expected...from prosecuting the work to a conclusion[2].

But Munro noted in 1827 that

in Tinnivelly there is no system of revenue management ; the system, such as it is, is calculated to keep the Collector in ignorance of the state of the district. ... There are no detailed accounts... in his cutcherry that can be depended upon. Too much is left to the curnums ; they distribute the assessment ; ... they assess the ryots as they please ; they remeasure the lands of many every year[3].

Of Madura and Dindigul Munro writes ;

The survey and assessment was made by Mr. Hurdis [I, 114]. ... The fields are not numbered, ... but in Dindigul the assessment of each field is inserted in the register, so that each ryot knows what he has to pay to Government. In Madura the fields are registered in different classes ; ... the extent of each is shown, but not its money assessment. In both districts very little care has been taken to preserve the survey accounts[4].

In 1812 it is recorded that

the permanent settlement which was introduced into the province of Dindigul totally failed ; and, after sustaining a considerable loss of revenue, the Madras Government has been obliged to resort to the establishment of a system of village leases[5].

Of North Arcot the Collector wrote in 1804 that,

in order to secure Cultivators from undefined or immoderate exaction it is not necessary to measure the country. The settlement of last year is founded on principles adequate to the attainment of this object. ... But, with a view to correct the many errors which may be supposed to exist in the present register of the measurements of the fields ; ... in order to fix a rent upon equitable principles ; ... likewise of discovering the encroachments which have been made on the Government Lands by irregular alienations, and unauthorized privileges ; I consider a survey of the Country as conducing to the benefit of Cultivators and the stability of Revenue. ...

I have to submit...an Estimate of the expence of measuring this Division of Arcot, including the small district of Venketgherry above the Ghauts. The Estimate amounts to Star Pagodas 6,060[6].

The survey was carried out in 1807 and seventy years later it was recorded that the accounts known as the district paimash are valuable records, still carefully preserved and frequently referred to. The work included both a general survey and a classification, with assessments of all lands. By the survey all lands, both cultivated and waste, were divided into lots each bearing a number, and the extent of each was recorded[7].

Of Pālnād, now part of Guntūr District, Government commended the work of the Collector, who,

altho' his endeavors to accomplish the introduction of a ryotwar settlement...were not entirely successful, ... has been enabled to conclude a settlement of that district for Fusly 1214 [A.D. 1804–5], on principles so nearly resembling the system...introduced in other districts...that the apportionment of the rent paid by each ryot on the different descriptions of land cultivated by him appears only to be wanting, and, as the survey of the lands...has been concluded, His Lordship in Council entertains confident expectations that the opposition of the inhabitants to the ryotwar system will soon yield to their conviction of its advantage[8].

Of Tanjore the Directors write in 1803 ;

The arrangements proposed...appear to have for their object the ascertainment of the real resources of the Tanjore Province, combined with the happiness of the people, as preparatory to the introduction of a permanent settlement of the Revenues similar to that now in progress for the lands in the Company's Jaghire and Northern Circars. With this view it appears that the Collector has already commenced a measurement of the lands, in which we trust he will persevere, notwithstanding the continued efforts of the Landholders in opposition thereto. ...

[1] Chingleput [I, 141–3]. [2] MRC. 13–8–03 ; Stephen Rumbold Lushington (1775–1868) ; MCS. 1790–1807 ; Collr. Tinnevelly 1801–3 ; auth. of Life of his father-in-law, Gen. Lord Harris [I, xix]. [3] Arbuthnot, I (281). [4] ib. (285). [5] CD to B. 15–1–12 (67). [6] M Rev Bd. 2–7–04. [7] *North Arcot* 121). [8] MRC. 15–3–06.

There is no expedient...which would tend more to augment the Revenues than an accurate survey of the lands[1].

On the other hand, Munro writes in 1827 ;

Although Tanjore has been so long in our possession, very little progress has been yet made in the establishment of a fixed assessment on the land. Assessments have been made on an estimate of the value of the grain produced ; this leaves the extent of land and the rate of assessment on each field in each village uncertain ; and, as a field assessment can only be effected by means of a survey, it ought to be begun without delay. The survey ought to be made upon the same principles as in those districts where the most complete surveys have been made. ...

Trichinopoly, by having a register of fields and a fixed assessment upon each, possesses the means by which its annual land-rent may be easily & fairly settled[2].

Mackenzie abandoned his first idea of making an *agricultural survey* of Mysore, that should ascertain "the quality of the cultivated lands, their several kinds, the tanks and waterworks" [92, 103], and we have no record of any such revenue survey being carried out in Mysore at this period. It is recorded, however, that before Haidar Ali's era Rāja Chikka Devi had regular field surveys and settlements made[3], and that "the mode of estimating the quantity of land in Mysore is not by actual measurement, but by the quantity of seed grain required to sow the arable land"[4].

An experimental survey was however made by two of Mackenzie's assistants of a village in Kurnool District, on scale 400 feet to an inch, which showed the village boundary, all water channels, and field partitions. Measurement was made separately by 24 and 21 feet rods, and distinguished paddy fields, dry grain, waste land, and cocoanut groves[5].

ASSISTANT REVENUE SURVEYORS

The duties of the assistant revenue surveyors sent out from the observatory training school were, first, a general survey of the districts to which they were posted, followed by a particular survey to include all the tanks and reservoirs, rivers and water channels, administrative and estate boundaries, limits of cultivation, and any other detail required by the Collector [I, 145–6].

Some of these surveyors worked under the professional superintendence of the Inspector of Tank Repairs [I, 108–9 ; II 139, 341], and the remainder, though under the direct orders of the Collectors, were under the professional guidance of the Inspector of Revenue Surveys, otherwise the Astronomer, who examined the results of their work, and compiled the district maps.

Although it was clearly stated that the boys were "educated solely for the service of the Revenue Department", the measurement of fields was definitely beyond their functions [346–8],[6] and the duties above defined provided ample work for several years. There was a continued demand for their services, and orders had to be issued to prevent their diversion to non-professional work;

Collectors are strictly prohibited from employing their surveyors as Writers in their Cutcheries [140, 141] ; such a practice defeating the object of the Institution ; should a surveyor prove inadequate to the Task required of him, the case is to be represented to the Board of Revenue, who will cause him to be removed[7].

Although much useful work was done by these young surveyors, some was of a very poor quality [140, 147, 151] ; the Collectors had no professional knowledge, and were far too busy to give them any serious attention, whilst the Inspector of Revenue Surveys never made any attempt to visit them at work in the districts. It is, therefore, no wonder that the Commander-in-Chief recommended in 1810 that "the office of the Inspector of Revenue Surveys...should...be suppressed"[8] [2, 299–300].

[1] CD to M (Rev), 18–3–03 (6). [2] Arbuthnot I (281). [3] Nicholson (93, 96). [4] Wilks (47). [5] Fdbk. MRIO. M 28, village of Kodialum in *Konaad taluk*, by Pope and Faulkner. [6] DDn. 324 (165/9) 17–1–07. [7] DDn. 133 (303/5) 17–1–07. [8] General Hewett's Report, 27–8–10 (247) ; DDn. 84 (9).

Control of these surveyors was transferred to the Surveyor General from the end of 1810; the district surveys still in progress were finished off, but no further work was taken up for the Revenue Board. Under Mackenzie's management it was already established that the topographical surveyors should survey all administrative boundaries, watercourses, and tanks, and collect statistical data useful to the civil administration, but though distinction was made between cultivated and jungle areas, it was not yet the established rule to survey their exact limits.

Survey of fields for assessment purposes was carried out by Indian methods and agency under the direct supervision of the Collectors [182–3]; the assistant revenue surveyors were not brought into this work except in the suburban areas of Madras, about which the Collector of Madras thus reported on the work of William Webbe between 1804 and 1807;

The duties of Mr. Webbe in this Office do not in my opinion require his keeping either a Field Book or a survey of the Division. He is employed in making Plans and measuring of the lands sold to Gentlemen and others within the limits of Madras. ...

The situation of Assistant Surveyor under the Collector of Madras is a place of very considerable trust. ... To the Assistant Surveyor are confided the interests of Government in the measurement of land, either to be purchased or sold, and surely his pecuniary interests, where he discharges his duties very satisfactorily as Mr. Webbe has done, ought not to be overlooked[1].

It is not clear who relieved Webbe in 1807; possibly Johnson [140], who was on this duty in 1810 when the Governor noted that

an Assistant Surveyor may, I conceive, be always employed to advantage under the Collector of Madras. The valuable property in the lands of Madras might suggest the propriety of a regular survey of them all being made, in order that the right of the Government and of individuals might always be clearly defined and ascertained, and the expense of one of the Assistants might be defrayed with propriety by the Collector's establishment[2].

The Board of Revenue records that,

having understood that abuses had taken place in the settlement, and in the issue of Grants and Certificates for the lands and houses in the vicinity of Madras, the Collector instituted an enquiry into the subject which has confirmed the information he received. A considerable number of houses in the village of St. Thomé have been discovered to be held without any Grant or Certificate, and a permanent addition has been made to the revenue by assessing upon these houses an annual Quit Rent. ...

In consequence of this confirmation of his suspicions, and other circumstances, ... the Collector, being of opinion that the revenue might be considerably increased by a complete survey of the whole Talook, has deputed for that purpose the Assistant Surveyor attached to his Department. ...

Assistant Surveyor J. A. Johnson will proceed forthwith to St. Thomé, and make a complete Survey of that village. He will prepare a general plan, ... with table shewing the extent of the several descriptions of land and the names of the proprietors[3].

It is probably a map of Johnson's that is now preserved in the British Museum, "the Environs of Madras, surveyed 1814[4]", but there is no evidence as to who made a "Particular Survey of Tondaharpettah," north of Blacktown[5] [I, 94], shewing fences and boundaries, "scale 200 feet to an inch, July 9th 1801"[6].

BOMBAY & SALSETTE ISLANDS

Several surveys were made of Bombay and Salsette during the 18th century [I, 120, 147], but the city was fast extending, and the neighbouring lands rapidly increasing in value. A General Order of November 1803 tells of another attempt to start a regular large-scale survey;

Lieutenant Goodfellow having been prevented from making material progress in the Survey of the Mazagon Estate by being called away on other professional duty, the Honorable the Governor in Council has been pleased to appoint Captain Brooks to proceed with the said Survey, and to continue it through the Island, as well in view to Revenue purposes, as to political utility, ascertaining and laying down...the exact limits of each Estate, and noting

[1] From Collector, 28–8–07; M. Rev Bd. 4–9–07. [2] MMC. 29–1–11. [3] M Rev Bd. 9–9–11. [4] BM. K 115 (75/1). [5] Now George Town. [6] MRO. Map 59.

the particular tenure, or tenures on which they are severally held[1].

There is no record of the work carried out either by Goodfellow or Brooks [I, 315], but in December 1810 another Engineer officer, John Hawkins, was directed to get into touch with the Collector's office and to

enter upon the survey on the 1st of the ensuing month of January, commencing in the first instance with the Oarts situated in the Bombay District [I, 147 n.5]; you will ascertain the number of Cocoanut, Brab, Date, or Betelnut Trees there may be in each Oart, the proprietors of them, their quantities, and...whether the Trees be drawn...for distillation, for the sale of the Liquor in the crude state, or whether allowed to run to fruit; what may be the average number of Cocoanuts produced annually by each Cocoanut Tree, and for how many years they continue productive in that state. ...

Having completed the survey of the Bombay District, you will be pleased to deliver in your report for that division of the Island, and then proceed on a similar survey of the Mahim District[2].

The need for detailed survey was stressed by the Assistant Collector in charge of the island of Karanja;

Under the supposition that the Land Revenue on this Island is considerably less than should be yielded, in consequence of the incorrectness of the survey which was made in 1796–7[3], and agreeable to which the land is at present assessed, I have had two villages Surveyed. ...

It appears that even in these two villages alone there is a defalcation in the Revenue to the amount of rupees 457-3-29, and...it is but reasonable to infer that the rest of the Island pays less tax in a proportionate degree. ... I therefore...recommend...the Islands, Elephanta and Hog, to be surveyed, to effect which...an expence of about four hundred rupees would be incurred.

In sanctioning this survey Government wished that it should

not be conducted with any degree of rigid precision, that should give disgust or offence to the inhabitants, but rather upon a liberal scale, to accord with the system of encouragement which hereafter obtained in the Island[4].

In February 1812, Hawkins handed over to Dickinson, who held charge for the next eight years [8], and in May Dickinson submitted

a survey of the Oarts of Mahim District, including those at Worlee, Sion, Sworee, Parele, and its vicinity, to a careful examination of which I have devoted the last nine months, not more than 50 having been inspected when I entered upon the survey.

Throughout the duties...I have invariably been met with the greatest civility and respect from the inhabitants, and...my duties have been much facilitated by the very great assistance at all times afforded me by the Collector. ...

I am desirous of submitting a plan sufficiently comprehensive for every revenue purpose... and exhibiting on an immense scale, not only the exact contents and Boundaries of each estate, but every species of property. ... Each sheet...to be accompanied by 2 books, one for registering the Tenures, and containing a rental of every part of the Island let out by lease; ... the other a census specifying the number of Men, Women, and Children, in each caste. ... I beg leave to recommend that fair copies of each sheet...be deposited with the explanatory books in the Collector's office[5].

Progress was bound to be slow, for several reasons;

The confusion and gross inaccuracy of most of the records in the Collector's office, and in many instances the total want of any, were the causes which led to the Revenue Survey. ... The actual survey or measurement of the lands on the Island is an undertaking still almost in its infancy, owing to other duties which were required of me and my predecessor, viz., a minute examination of all the cocoanut Oarts...and classification of their various products, which duty was not completed before the beginning of June last— ...

The enormous scale on which the work is carrying on, in order to assure the greatest possible accuracy where ground, particularly within the Fort, is of such incredible value—

The length of time and extreme caution...to be observed in examining the proprietors tenures, and reporting upon their degrees of validity, and the accuracy of their contents, many of them being in foreign languages— ... The extra duties incidental to the situation of Revenue Surveyor, whose Business it also is to measure out all pieces of ground petitioned for, in any part of the Island. ...

In consideration of...the very intricate division of property everywhere, added to the

[1] Bo MC. 11–10–15. [2] Bo RC. 28–12–10. [3] no particulars found. [4] ib. 29–4–12. [5] ib. 8–7–12.

circumstance of my not being able, from the nature of the climate, to dedicate a very large portion of the day to the practical part of this Duty, ... 4 years will not exceed the time necessary[1].

To speed up the work he was given two assistants, Gordon and Remon, from October 1812, and by the following July he had the further assistance of Macleod and Tate [323], of whom he proposed

that Mr. Macleod be permanently attached as Junior Assistant to this department, who is capable of combining the laborious duties out of Doors with those of a more Sedentary nature in the office. ... Mr. Tate's constitution will not, I fear, for some time to come admit of his being of much use out of doors ; to a masterly performance, however, of the duties in the Office, his Talents are eminently adapted. ...

After the monsoon, ... I shall be enabled either to go myself, or detach an Assistant, to Caranjah[2].

Government was impatient for completion, and told the Board of Revenue that,

considering the very limited extent of the Island, and the establishment allowed for the Survey, the Governor in Council cannot help viewing four or five years a very long time for its completion. ... It will become the duty of the Board to take into its consideration the expediency of augmenting Lieutenant Dickinson's establishment, as until the survey be completed it will be difficult to adjust all the arrangements necessary to a general improvement of the Revenue of the Island.

Lieutenant Dickinson is also to be called upon to deliver in the surveys of Collabah and Old Woman's Island[3].

In December 1813 Dickinson submitted

an actual Survey of the Town in Duplicate, the larger, containing a minute Plan of the fortifications on the immense scale of forty feet to an inch, is intended...as a Document of universal reference ; ... the other, consisting of eighteen sheets, is more adapted for the use of the Collector, blended as it is with a Book of references. ...

Having...explained the nature of the existing Tenures under which the landed estates within the Fort are held, I...suggest such measures connected with the future adjustment of the ground rents...best calculated to promote the very desirable object which Government have in view[4].

The survey was now extended by Nutt and Tate to the Island of Salsette[5]. Nutt resigned two months later, after his work had been severely criticised by Dickinson and work then continued with Price and Ennis on Bombay Island, and Macleod and Tate on Salsette. In June 1815 Dickinson reported that

survey has been completed of the whole of the lands belonging to the village of Nadalla in the neighbourhood of Parell. ... Very considerable progress has likewise been made in the revenue survey of the Mattunga and Sion lands, also a Trigonometrical Basis established comprehending by far the Greater portion of the Mahim Division. ... Six hundred and seventy five more estates in the Old Town have...undergone...measurement and computation. ...

I have thought proper to transfer my operations to the adjoining district of Mattar, the survey of which has been lately commenced...upon the Island of Mhurr, on the Western coast of Salsette[6].

It is to be noted that Dickinson combined the two functions of settlement officer and surveyor and, though his survey stood the test of very many years [8] his settlement of tenures was by no means without critics, one of whom writes ;

That respectable officer could obtain but a limited insight into the nature of the landed property within the Fort, from not carrying his enquiries beyond the year 1720 [I, 147][7].

Several of the books of reference attached to Dickinson's survey are still preserved at Bombay[8], and reduced copies of his maps have been published several times[9]. Sir Patrick Cadell writes in 1946 that that when he was Collector of Bombay in 1905 Dickinson's was still regarded "as the standard survey".

[1] Letter of 27–9–12; Bo RC. 7–10–12. [2] ib. 11–8–13. [3] ib. 3–11–13. [4] ib. 29–12–13. [5] Bo GO. 5–1–14 ; Bo RC. 2–2–14. [6] ib. 14–6–20. [7] *Bo Geo Soc.*, 1839–41 (50–1). [8] Bo Sur. 1815 (1–4). [9] *Gaz. Bom. City* (328) ; Douglas, etc. ; Map : *The Island of Bombay, 1812–7 ;* 1 inch to 1200 yards ; pub. London, 1843 ; *Imp Lib M & P.* 528.

BROACH

Broach was captured from the Marāthas by the Company's troops in 1772 [I, 121], but restored ten years later. It came once again to the Company under treaties of 1802 and 1803[1].

Both during the first occupation and after the final cession the Directors called for an investigation of the revenues, and Reynolds, who had taken part in the first survey of 1779 [I, 122], had the satisfaction of putting forward in 1806 his proposals for a detailed land survey[2]. In 1810 the Directors wrote out ;

> It will be necessary that the projected Survey of Broach shall be completed and, should the experiment...be successful, ... it may afterwards be tried in the other Districts.
>
> It will be proper also that you shall previously require much more accurate information than you now possess respecting the manner in which the Patels collect the Rent and Revenue from the Ryotts, and the exact Relations in which these two Classes stand to each other[3].

The following year Williams made an experimental survey of one village[4], and after a study of his "delineations and explanatory Tables" Government resolved on a complete survey of the Purgunnah and, being...impressed with...Captain Williams' observation that a revenue settlement and adjustment of claims...should be contemporaneous with the survey, the Governor in Council directs that the Collector and Surveyor General do form a committee for this purpose, and...investigate and finally adjust the rights of each holder. ...

> The committee should adopt a moderate and conciliatory line of conduct towards the Ryots, such as will tend to satisfy them that the object in view is not to interfere with...their individual rights or properties, but will be confined to the just measure of reclaiming to Government their portions of what may have been improperly alienated or concealed. ... The ryots are to have full liberty to appeal from the committee to the Judge and Magistrate. ...
>
> A detailed statement of the population of the Purgunnah, distinguishing every different caste, is to be obtained.
>
> The ascertainment of the quantity, situation, and quality, of all the waste lands is an object of primary importance. The disposal of them to encourage cultivation must be taken into consideration. ...
>
> It appears by the...letter from the Hon'ble Court of Directors, ... that...it would be necessary to complete the projected survey of Baroche before the formation of a permanent settlement could take place. ... When the survey and final adjustment of claims shall have been completed in one or two villages, a detailed report is to be made to Government[5].

The Surveyor General started with two assistants, Nutt and Cruikshank, and four more joined later. He reported in October that

> it is difficult...to judge exactly of the time which will be required to complete the survey... but I have reason to believe that it will be done by the month of August next [1813]. The four officers who joined...in March, April, and May last, have been practising diligently ever since ; they are...now capable of, and are each separately employed on the survey of the lands of different villages.
>
> With the view of making a commencement in the jurisdictions of Kaira and Surat with as little loss of time as possible, it would...be advisable to attach immediately six more officers to the Department, who should practice under those now carrying on the surveys in this district. ... As soon as they had attained a sufficient knowledge of the duty, I would...proceed to Kairah and make arrangements with the Collector there for the employment of one half of the Surveyors...in his districts. More officers might then be added in order to provide a supply of Surveyors for the Purgunnas forming the Surat Collectorship[6].

With six assistants survey of Broach *pargana* was completed by July 1813 and, claims Williams,

> combined with the settlement of the lands, ... has been attended by a large augmentation to the Hon'ble Company's revenue, and has established a precedent for extending this advantageous operation over all the British territories subject to this Presidency[7].

The final reports were submitted in March 1814 ;

> The investigation and adjustment of claims have been brought to a termination. ... Statement No. 1 will exhibit...the quantity of land of all description in every village...according

[1] Two *parganas* from the Peshwa under treaty of Bassein, 31–12–02, and three from Sindhia, August 1803. [2] Bo MC. 17–4–07. [3] CD to Bo. (Rev), 10–1–10 (126). [4] Umlesur, Broach *pargana*, survd. by Cruikshank, March 1812, 6 inches to mile, MRIO. 122 (12). [5] Bo RC. 11–12–11. [6] From SG. 12–10–12; Bo RC. 81/1812. [7] Bo MC. 11–2–15.

to the Survey settlement now made. ... The final arrangement...will comprise all the general statements of land, population, and such other information as may be judged useful[1].

The Survey was first ordered in 1811 ; but, being a new measure and of doubtful issue, it was proceeded in cautiously and slowly at the commencement. As experience demonstrated the practicability and manifold advantages of the plan, additional means were employed ; and the whole of the original Baroche collectorate, viz., the Baroche, Unklesur, and Hansote Parganas, was completed early in 1816.

No question as to rights regarding a single field remained unadjusted.

Besides these acquisitions, a record was formed, and is lodged in the Collector's office, which—contains a plan of the lands and boundaries of every village—shows the situation and measurement of every field of rent-free land in every village—gives the name and place of residence of every land-holder, with the number of his fields, and their situation and measurement. ... The plans and statements are finished in a very superior style, and the value of them will increase with the lapse of time. ...

A plan of each purganna separately, and of the whole collectorate united, constructed from the village plans, reduced from the original scale of six inches to one British mile, and joined ; and the connection of the village plans for this purpose was a proof of the accuracy of each and of the whole. The purgunna and collectorate maps show, not only the position, but the boundary of every village, and every topographical particular of the face of the country[2] [8].

[1] Report, 21–3–14 ; Bo Sur. 1814/8A. [2] *Memoir on the zilla of Baroche.* *Bo Sel.* III.

CHAPTER XIV

ASTRONOMICAL CONTROL

Bengal — Madras Surveyors — Madras Observatory.

ALTHOUGH triangulation was rapidly becoming established as the normal foundation of every survey in the south peninsula, the flat tree-covered plains of the Ganges valley, the wide featureless spaces of the Punjab, and the dense forests of Central India, left the Bengal surveyors dependent on astronomical control till Everest brought the triangles and towers of the Great Trigonometrical Survey to Upper India.

Though there was still no certainty or exactness in this astronomical control certain main points were now fairly well established through constant repetition, and the improvement of instruments and astronomical tables. There was, however, no attempt to extend the good work started by Reuben Burrow of spreading a wide pattern of astronomical fixings of uniform first-class standard. Each surveyor, as he extended into new country, made his own observations with his own instruments, and often with but little skill.

The uncertainty of casual observations for longitude still left ground measurements the more generally trustworthy, and even check against corresponding observations at the Greenwich or Madras observatories left wide margin for uncertainty[1]. Although Goldingham reduced to a uniform series the longitudes which Dr. Hunter had observed between 1792 and 1796 [I, 168], the Asiatic Society decided not to publish his paper because there was no prospect of the results being precise or final;

In the western parts of India we are in possession of better materials for fixing the geographical situations of several points noticed by Mr. Goldingham ; that is, geometrical surveys connecting them with places whose longitudes have been ascertained by numerous and accurate obsrvations. At several of the places in Mr. Goldingham's list I had only one observation, and I did not depend on that in fixing the positions of those places. ...

I annex the Longitudes of a few principal places as fixed by the Surveyor General from comparison of all the materials in his possession ;

Futtehgurh	79° 36′ 40″	Good.
Agra (Taj Mahal)[2]	78°	The meridian cuts thro' the Taj.
Oujein	75° 55′	Good.
Bublana	75° 37′ 30″.	
Dehly	77° 10′.	

The longitudes of the three last places as deduced by Mr. Goldingham from my observations come surprizingly near those which are ascertained from the best materials in the possession of the Surveyor General here[3].

Colebrooke also wrote to Warren at the same time ;

I found on examination that the Longitudes he [Goldingham] gives of various places in Hindoostan, all of which are included in my maps, did not all agree with the positions I had assigned to them, most of which are either taken, or derived by survey, from the observations of the late Mr. Reuben Burrow, as published in the 4th Vol. of Asiatic Researches [I, 162].

I have had occasion, however, to correct R.B.'s Longitude at Cawnpore, and of every place West of that meridian, in consequence of not finding the difference of Longitude between Allahabad and Cawnpoor to agree with a very correct survey of the River between those two

[1] The fundamental longitudes of Calcutta and Madras had been discussed at length by Colebrooke and Goldingham between 1800 and 1803 [I, 180–1], and were the subject of a paper read before the RS. by Goldingham, 27–6–22. [2] Hoare's value, 1795–6, 78° 08′ 07″ [I, 168]. [3] Hunter to Warren, 14–12–06 DDn. 47 (29–31).

places, to the amount of 6½′ nearly, which is the only alteration I have ever made, and which error I suppose might have been owing to his Chronometer having run down between those two places, for I find all the rest of his Longitudes to agree with the surveys [I, 163]. ...

I should esteem it a very particular favour if you would take the trouble of sending me a list of all the Immersions and Emersions of Jupiter's 1st and 2nd Satellites which have been observed at Madras, with their correspondent ones at Greenwich, as I wish much to see what the result will then be, abstracted from all other observations[1] [II, 195].

Colebrooke, as we have already noted, was himself a very keen astronomer [I, 167]. He had in 1795 acquired a special instrument for taking astronomical observations at Calcutta [I, 202], but had afterwards found it impossible to spare the time;

Being about to remove the Surveyor General's Office, I beg leave to acquaint you that there are in the office the following instruments for Astronomical observations, which, partly from their unwieldy nature, and the want of assistants in that branch of science, have long been out of use. viz.—1 Circular Instrument by Troughton[2], 2 feet Diameter, with a Triangular block of stone to serve as a stand [I, 202], and other apparatus belonging to it—1 Astronomical Quadrant by Ramsden[3], in a Mahogany case, with its stand. ...

These instruments might become useful at some future period in case an observatory should ever be establishment at Calcutta, and as they can never more be of use in this office unless an assistant for making Astronomical observations should be appointed, I beg leave to request...their being received and deposited in the Arsenal[4].

As compared with longitude observations, those for latitude gave such favourable results that surveyors were encouraged to make them, even for such small areas as the Environs of Calcutta, surveyed by Fleming in 1801–2 [12–3]. Colebrooke writes to Sackville, who had done no astronomy before [48–9];

You need not attempt Longitude by celestial observation, as the Longitudes of Calpy, Allahabad, and some other points with which the survey will connect, are sufficiently well known, and you could not...observe the Longitude nearer than 8 or 10 miles of the truth, as the Tables, even Jupiter's Satellites, are liable to an error of that amount.

The Latitudes, again, are essentially necessary for correcting your survey which, being connected up by compass and perambulator, or bearing and distance, and not by a regular series of triangles, would be liable to considerable errors if not checked or corrected by a few good Latitudes.

For this purpose it is necessary to make yourself acquainted with some of the principal stars that are proper for the observation, and to calculate their declinations with the greatest nicety. The season for observing the Latitude by the Sun is now almost over [*inf*], but, I hope you have availed yourself of the late cold weather for doing so, though I do not observe the results of any of your observations entered in your Field Books.

If you are in want of any Books upon the subject of practical Astronomy, I will endeavour to procure for you a Treatise that will answer your purpose. ... If you are in want of a good Artificial Horizon, I will also send you one. A sextant I suppose you are already in possession of; indeed I could not easily get you a good one in Calcutta at present.

In observing the Latitude, the more observations you can get at any one place, the better. I think four at least are necessary, and, if by the stars, two, or half of the set, should be on each side of the Zenith[5].

Should you...become a proficient in observing the stars, I would rather you should not attempt at first to correct your survey by the observations, but merely to give the results in your Field Book, or in a corner of the map, marking the places where the observations were made[6].

Mention of the *season* for observation of the sun refers to the impossibility of getting a reflection in mercury when the sun is at high altitude, and in this connection a novel proposal was put forward by the marine surveyor, Knox [10–2].

As latitudes with an artificial horizon can only be got 1/3rd part of the year at the north end of the Company's dominions, and at the south part scarcely 1/6th part of the year round, I wish that my health would permit...to bring in to practice what seems to me perfect in theory. ... I have never heard of the thing that I am proposing, but it is only simply to have a vertical reflector, and take the zenith distance and correct for the latitude. This reflector

[1] DDn. 47., 18–12–06. [2] Edward Troughton (1753–1835); FRS.; *DNB.* [I, 201]. [3] Jesse Ramsden (1735–1800); FRS.; Portrait, *Empire Survey Review*, 52. VII. April 1944, pl. III; *DNB.* [I, 165 n.2]. [4] DDn. 67 (358), 25–1–05. [5] ib., (523), 17–3–06. [6] DDn. 79 (D), 27–8–06.

I would have fixed to metal, and a spirit level fitted firm to it at right angles. Consequently when the level is horizontal the reflector will be perpendicular. Observe to set it true to face the true meridian, and let it stand above the observer.

Few people are willing to watch the stars round the night, when they conceive it a time to refresh or amuse themselves[1].

The Surveyor General writes to White, who was working west of the Jumna [59–60];

With respect to a Chronometer, it will not be possible to procure you a good one, and there is the less necessity for it, as your longitudes (supposing your survey to be correct and the latitudes well ascertained) can be better derived from survey. The longitudes of Delhi, Agra, Muthra, are now known to a mile nearly, and if you connect your survey with those three points there is little danger of your being much out in longitude in any part of your maps. ...

I have transcribed also some examples of observations for the latitude which I hope will be useful, and I send you the latitudes and longitudes of Delhi, Muthra, and Agra, as they are laid down in my most correct map. These places have been deduced, by survey as well as chronometers, from Anopshere, Futtehghur, and Cawnpoor, the longitudes of which have been observed by the late Mr. Reuben Burrow, and I conceive that no observations for longitude, unless taken at a fixed station, and for a considerable length of time, could be more correct than what he has given[2].

White reports two years later;

The latitudes of all the principal Towns...are ascertained by Astronomical Observations. ... The Latitude of the Jumma Musjid, Delhi, being by a mean of observations 28° 38′ 40″. Their Longitudes...are regulated by measurement, which I conceive to be a much more accurate way...than by double allowances with the Chronometer; for it is in the first place but seldom that a good Chronometer can be procured, and then, from the injury it must suffer from the continual marching, no correct allowance can be made for its general rate of going, and a few seconds, though a trifling error on board a ship, would make a serious difference in a map[3].

To encourage surveyors to take astronomical observations, Garstin, who succeeded Colebrooke in 1808, got permission to hold a number of instruments on charge;

Several of the officers employed on surveys are desirous of correcting their common measurements by observations of the celestial bodies and have, by pursuing astronomical studies, rendered themselves qualified to determine both the latitudes and longitudes of principal places; but...the expense of providing the proper instruments is so great that they cannot afford to purchase them out of the usual allowances granted to surveyors. ...

In the year 1780, when the allowances for surveyors were reduced and settled[4], very few of the Gentlemen...understood astronomy [I, 270], and...the purchase of chronometers and telescopes [was] not then thought of, not being in use. ... It is much to be regretted that Lieutenant Webb was not supplied with these instruments when he went to the Gangoutri [76][5].

He wrote to Sackville;

I have applied to Government for permission to purchase a Chronometer, and if it is obtained will send it up by Dawk without the loss of a day. Having strongly recommended it, I hope, in spite of the rigid tho' necessary system of economy adopted, to succeed, as it is for the real benefit of the service[6].

The instruction of young officers in astronomy had been first started under Burrow, and more recently urged by Colebrooke, and in 1810 Garstin reported that the young engineer officers, Peckett and Stephen, whom he was sending out on survey under Sackville,

have taken great pains to learn practical Astronomy and, having been kindly assisted by the Revd. Mr. Thompson[7], have made so great a progress that there can be no doubt of their being very soon able to apply their knowledge to surveying [25, 309][8].

Sackville had already reported that

Ensign Blane has already obtained a very tolerable use of the sextant, and can take an altitude of the sun with considerable exactness. We have commenced our observations of the stars, and are daily becoming better acquainted with their situations in the different

[1] Fdbk., 1804; DDn. 48. [2] DDn. 67 (464), 27–5–06. [3] DDn. 82 (41), 9–11–08. [4] 1785 [I, 277]. [5] DDn. 81 (57), 9–1–09. [6] ib. (213), 5–10–08. [7] Thomas Truebody Thomason—father of James Thomason (1804–53); *DNB.*; Lt Govr. of NWP. and founder of Engr. Coll. Roorkee—father-in-law of W. G. Stephen [*sup*]. [8] DDn. 126 (64), 12–9–10.

constellations at present observable. As soon as the chronometer arrives we shall commence our observations for the longitude, a desideratum I believe much required in the province of Cuttack[1].

to which Garstin replied ;

The Chronometer is ready and in excellent order ; I am enquiring for some officer going to Cuttack to take charge of it who can be relied upon to wind it up carefully. You are sufficiently aware of the great utility of Astronomical observations, and I hope to have Ensign Blane return in a few months a tolerable proficient in Astronomy, as well as a correct surveyor [24–5].

The chronometer reached Sackville safely but

The Time keeper, I am sorry to say, stopped during our stay at Ganjam after the hour hand had performed its twentieth revolution, and is no longer of any use. From what cause this misfortune could have arrived I am at a loss to guess. I regularly and carefully wound it on every day at the same time. On the march I had it carried in a bearer's hand by my side, and in my tent never allowed it to be put out of my sight.

It had previously gone very irregularly, and we were employing ourselves at the time in reading its average rate of going, to enable us, from the known longitude of Ganjam, to carry on our observations from that place on our return to Calcutta[2].

Garstin wrote to Crawford at the start of his survey of Mirzāpur ;

I well know you can observe correctly, but as it will save much valuable time, and some trouble, I send you a list of places that are within the limits of your survey or on the borders of it laid down from the result of many observations made by Mr. Reuben Burrow, who determined the Longitude of the Granary at Bankipoor from the mean of upwards of one hundred observations while residing with me at Patna, and took nearly as much pains with the others [I, 161]. These points being so accurately established, all the other places must be very correct[3].

Crawford himself was an enthusiastic astronomer, and when he succeeded as Surveyor General not only persuaded Government to give him an assistant to help in making regular observations at the Calcutta office, but undertook to instruct any young officers who might care to learn ;

Your Lordship must be perfectly acquainted with the great and infinite advantage arising from having corresponding Astronomical Observations made at the Capital, and by the surveyors that are...detached from that Capital. At Madras they can boast of having an Observatory, as Astronomer, and an Assistant, whilst here, the seat of Supreme Government, the Capital of all India, we have no such advantage.

Should your Lordship be graciously pleased to grant any extra allowance, to enable me to keep an Assistant to aid in making all the Astronomical Observations and calculations, ... the spirit of my profession prompts me to make the following offers.

That I would with pleasure dedicate two hours every day to the instruction of those young officers who might wish to become surveyors, as well as giving them that knowledge of practical astronomy so as to enable them to commence upon their surveys with benefit to themselves, and advantage to the State. And, from the same motives, I would willingly take charge of, and keep in order, all the mathematical instruments and Chronometers that might be sent out by the Hon'ble Court of Directors. The great benefit arising from this would be that the Chronometers would not only be always kept going, which is a great consideration, but their respective rates would also be always ascertained[4].

This proposal was sanctioned and observations and classes were kept up for the two years that Crawford continued as Surveyor General.

Franklin made frequent observations in Bundelkhand [51–2] ;

From the middle of Jany. to the middle of last month, the weather was so unfavorable that I was unable to get a single observation. Since that time, however, I have generally used Mercury without any covering, and defended it from the wind by a thick cloth held up to windward. ... At first I used a floating glass...but I soon discontinued it, and have latterly used the Mercury with gauze in the manner recommended by Mr. Burrow [I, 162][5].

One of the most enthusiastic observers was Hodgson, who provided himself with the very best instruments suitable for field work, read up all the most advanced textbooks, and eventually acquired a wide reputation as astronomer. On his survey between Meerut and Sahāranpur,

[1] DDn. 82 (30), 1–12–09. [2] ib. (138), 1–3–10. [3] ib. 126 (138), 29–4–12. [4] ib. 143 (17), 7–12–13. [5] ib. 130 (171), 3–3–14.

I...almost daily take Latitudes, rigidly observe the sextant's Error at each observation, & reduce the daily Variation of the Sun's Declination to the nearest minute of Longitude on Map by the Tables of De Rios, & making all other requisite equations[1].

A list of his observations published in *Asiatic Researches* gives

Latitudes of Places in Hindustan and the Northern Mountains ; with observations of Longitude in the Mountains, according to Immersions and Emersions of Jupiter's Satellites[2].

Surveyors working in the Himālaya districts found that latitude observations were more reliable than measurements taken along the steep winding mountain tracks. They had as yet, however, no suspicion of the misleading effects of local attraction, though Lambton was fully aware of them [201].

Hodgson thus decribes his observation of an eclipse of the moon on 26th December 1814, near the Nepāl frontier ;

The beginning of the moon's eclipse was observed with the large Telescope. ... Having the satellites of Jupiter to observe, I did not pay much attention to the progress of the Eclipse as there were no stars in the moon's path likely to be occulted. I intended to have observed the end of the eclipse, but the cold and damp were severe, and I went in and, to say the truth, fell asleep and lost it[3].

MADRAS SURVEYORS

The topography of South India is in general so favourable to triangulation that we find but few references to astronomical observations being used on field surveys. Mackenzie was, however, by no means indifferent to their value and records that

the utility of verifying some points by astronomical observation was sufficiently understood and suggested by me at an early period [92], tho' I conceived the additional expence of an Establishment for that purpose alone might not be approved of. ... On former occasions I had obtained an Assistant[4], and provided Telescopes, Time-keepers, etc. (at my private expence), which were also used...in taking the observations for the Latitudes, whose coincidence with the distances indicated by our Triangles appear in the accompanying papers[5].

Attached to the Memoir of the Mysore Survey was a table of 13 latitudes observed by Thomas Arthur along the north-west frontier between May 1800 and December 1801 ;

The Observations for the Latitude & Variation were taken...with an excellent Sextant of 8 Inches Radius made by Mr. Stancliffe of London[6], ... and an Artificial Horizon was used with a Roof of Ground Glass[7].

Later, when in charge of the survey of Travancore, Arthur describes his difficulties in obtaining observations for latitude, the sun being too high in the heavens for the greater part of the year [191], and cloudy nights preventing any view of the stars for months on end. In due course he got his latitudes and variation of the compass ;

It was not till very lately that we had it in our power to determine the Longitude by an observation of Jupiter's Satellites. Having at length procured a watch that counted seconds, we observed the emersion of his 1st Satellite on January 15th 1810, and from thence deduced the Longitude of Bawaddy Kottah to be 76° 13′ 13″ from a single observation[8].

Garling made a number of observations during his survey of Goa [156–8];

On leaving Madras for Goa in October 1810, it was pointed out to me, both by Major Lambton and Captain Warren, that the situation of Goa was such in relation to the Madras Observatory as made it very desirable to obtain some good observations of the Eclipses of Jupiter's satellites and, being very willing to make such observations as far as might be practicable, I was furnished with a Box Chronometer and a Dolland's Telescope from the Observatory.

The Chronometer, it was considered, might also be made useful in other observations, ... but...duties that arose from time to time...proved a serious obstacle to the chronometer being regularly wound up, as well as constantly to interfere with...any plan for obtaining a series of observations. The intention of obtaining any such series was therefore relinquished, but at

[1] DDn. (95), 14–11–13. [2] *As R.* XIV. 1822 (153–79). [3] Fdbk. Nepāl War, 1814–5 GBO. Lib., A.b.88. [4] Benjamin Sydenham [I, 175]. [5] DDn. 42 (1), Memoir (59); 12–7–03. [6] once foreman to Ramsden ; *Emp Svy Rev.* VII. 52. April 1844 (226-34). [7] ib. Memoir (11), 25–5–03. [8] MRIO. Memoir, M. 106, 18–1–10.

occasional convenient periods observations were taken...with great care. ... They consisted of 5 kinds :—

1st.—To ascertain the time of the Chronometer.
2nd.—Meridian altitudes of the Sun and Stars.
3rd.—Distances of the sun and moon, or moon and stars.
4th.—Eclipses of Jupiter's satellites.
5th.—Distances between the commet observed in October 1811 and certain stars.

All the angles have been observed by a good Ramsden's 9-inch sextant, which either had no index error, or has such error specified[1].

MADRAS OBSERVATORY

By the beginning of the 19th century, after eight years of existence, the Madras Observatory was well established as the one centre for astronomical research and record in India, and constant reference was being made to it [I, 170–4].

Besides holding the post of Company's Astronomer, Goldingham was Marine Surveyor [I, 174], Superintendent of the Surveying School [341–3], Inspector of Revenue Surveys [299–300], and for a short time held the surprising post of Civil Engineer, with charge of civil buildings and construction [I, 338]. Perhaps his most notable contribution to geography at this time was his computation of a value for longitude of the observatory as 80° 18′ 54″, the derivation of which he explains in correspondence with Colebrooke. While noting his conclusions Colebrooke pointed out that they could not be accepted as giving a final value which, he said, might well be anything between 80° 16′ 30″ and 80° 21′ 43″ [I, 181, II, 190 n.1][2].

In February 1805 Goldingham took furlough on medical certificate, and Warren was appointed to act for him. Warren continued the regular observations instituted by Goldingham, which were communicated to England, and occasionally published in *Asiatic Researches*. In 1807 he deduced a revised value for the longitude, 80° 17′ 21″ E., which was used for all official maps until 1905 [I, 180–1][3].

On return from Mysore in September 1806, Lambton lent his zenith sector to the observatory whilst working on computations and reports, and Warren observed constantly with it from October 1806 to June 1807, without perceiving any material change in its powers or mode of performing.

In undertaking a series of observations of zenith distances, I had in view to establish permanently the latitude of the Madras Observatory, on which there seemed still to be a doubt of several seconds, and also to verify the declination of several stars near the zenith which, for obtaining the latitudes of places, disagreed in their results[4].

During the economy drive of 1807–8 the expenses of the observatory came under review, and in urging the importance of its work, Petrie gave an account of its origin, and of his own observatory started in 1786 [I, 171–2]. He explained that its primary value was now to afford "a point of departure for the navigation of ships", and gave a summary of the regular observations[5].

He was warmly supported by Justice Andrew Scott[6] [I, 383 ; II, 265], who recommended that some new instruments,

as well as all the best Tables & Treatises on Astronomical Subjects...would render the Observatory more useful than it is, or ever has been. The comparing Observations with Computed Places of the Heavenly Bodies is one means of perfecting the Theory, by detecting the Errors of the Tables in use. ... The Improvement of the Tables of Jupiter's Satellites can only be done by a Series of Observations for a great length of time ; ... also Lunar Tables. ...

I do not conceive that either Captain Warren's merit or his labour are so generally understood as they deserve to be. He sent me his paper on Zenith Distances & on the Comet to peruse. ... When the result of what he has done...comes to be known in Europe, ... Captain Warren will be found entitled to praise. If he were to give up his situation at the Observatory at this time, I know of no one who could supply his place[7].

[1] DDn. 218 (246). [2] DDn. 47 (1–15), 21–3–03 ; BPC. 21–4–03 (26). True value 80° 14′ 54″. [3] Markham (64) *Meridional Arc*, clxxii–iii. *GTS*. II (xiv, 135). [4] *As R.*, X. 1808 (513). [5] Mack MSS. LVIII, 4–9–08. [6] (1752/3–1825). MCS ; 1st Judge, Madras, from 1803 ; unemployed from 1822 ; D. at Ft. St. George. [7] ib. (11), 9–9–08.

There were two Brahman assistants, whose
respective duties were nearly alike ; only one, having more experience than the other, observed more, and had greater advantages from speaking and writing better the English language. These duties (which no one man was capable of performing from one end of the year to the other) were to observe—the Sun's Transit every day at noon—The Eclipses of Jupiter's Satellites, which occur almost every night—The Transits of a certain number of fixt Stars necessary to regulate the astronomical Clock.

It is their business to make out the rate of the numerous time-keepers which are sent to the Observatory by Captains of Ships, and to hold constantly in readiness those accounts, to be sent at a moment's notice to the owners when they are recalled ; to Register the Diary and rates in the Records ; make out the yearly Calendar jointly with me, who project and prepare the Scientific part of it ; and to keep the Instruments in proper condition and Order, they being responsible to me and the public for them[1].

Boys of the Surveying School were called in to help with the annual returns ;

It has been the practice, ever since the foundation of the Observatory, to close the observations of the year on the 1st of January of the ensuing one ; they are then reduced and digested, and lastly copied fair for transmission to the Honorable Court of Directors by the February Fleet.

The observations, which require long and skilful computations, are always calculated by myself and two of the most advanced boys in the school ; the Bramins reduce the transits and what regards Time, and the whole is copied fair by such of the boys as write a good hand, neither of the Bramins being capable of it[2].

At the end of 1810 the observatory was placed under the general control of the Surveyor General, and on the resignation of Warren in December 1811 charge was held by Ward until the return of Goldingham, who resumed duty on 17th February 1812 after an absence of seven years.

The only available list of the instruments maintained includes—1 Transit Instrument by Stancliff—1 Portable Transit by Ramsden—3 Astronomical Clocks—3 Telescopes by Dollond—1 Circular Instrument[3]—the last of these being described by Warren as

an Excellent Circular Instrument of Great Power, ... never before our good fortune to Possess, which Lt Colonel Munro[4] had received from Europe and lent to the Observatory[5].

Goldingham's monthly bill for expenditure[6] amounted to ;

	Pgs.	Fnms.	Cash
Astronomer's Salary[7]	192	10	40
Head Bramin Assistant	35	..	..
Second „ „	25	..	..
Candles	1	21	..
Cleaning Clocks, etc.	8	34	12
Binding & repairing Books	11	20	6
Total ; Pagodas	74	2	58

[1] MMC. 4–6–11. [2] MRC. 6–11–10. [3] DDn. 132, 1–10–13. [4] John Munro (1775–1858) ; Mad. Inf. ; QMG. 1808 ; Resdt. Travancore 1813–8 [265]. [5] Annual Report, 1–1–09 ; MPC. 27–1–09. [6] M 567, 1–10–13. [7] Originally fixed for Topping [I, 280].

CHAPTER XV

PROFESSIONAL METHODS OF SURVEY

Military Route Surveys — Bengal Surveyors — Levelling — Mysore Survey; Base-lines — Triangulation — Detailed & Statistical Survey — Madras Military Institution — Traverse Tables — Fieldbooks & Journals.

THERE is little new to report in the methods of surveying the routes of marching troops. At the end of 1802 the Surveyor General suggested the republication of the order of 1788 [I, 196], which had brought in "many valuable Routes", and he now made provision

that in cases when Perambulators are not used, the intervals of time, to the nearest minute by a watch, be substituted...for the distances [I, 184], care being taken to insert occasional remarks as to the nature of the road and Country, the rate at which the Corps may be supposed to be moving, and to draw a line through the column whenever a halt should occur, to denote that the time thus lost is not to be taken into the computation of the distance. ... If the impediment be occasioned by a River, Swamp, or any other natural obstruction where a Perambulator could not be driven, nor a watch used with effect, the distances should be judged of, and set down, by the Eye[1].

The new order was not published until January 1804, and Colebrooke complains that many opportunities had probably been lost by the delay[2]. Copies were sent to Madras and Bombay for republication in those presidencies [123, 167]. As an allowance of Rs. 100 a month was given for routes which met the Surveyor General's approval, a constant stream poured in till, in 1807, Colebrooke cried a halt [222];

The Routes or Field Books...have in general fallen far short of what might have been expected, and...they have by no means answered the purposes intended.

The chief causes of this I take to be that the officers who are selected for this duty are not always qualified for it; that the perambulators which are issued out from the Company's stores are so slight in their construction as sometimes to fall to pieces at the very commencement of a march [228], and that, although by estimating the rate of travelling by a watch a very tolerable route may be kept, yet the custom of marching in the night frequently precludes the possibility of taking bearings correctly, or of noticing the villages or other objects which are passed [I, 187; II, 65]. ...

In times of peace, the marches of corps and detachments being chiefly over old beaten tracks which have been laid down with tolerable accuracy in the maps, little or no improvement can be expected...from such slight or cursory surveys [53]. ...

To save the Government an unnecessary expence, I...propose that the order, ... as far as it relates to the Hon'ble Company's provinces or the territories of the Nawaub of Oude, be rescinded; but that it be considered to continue in force whenever a Corps or Detachment shall pass the limits of the Company's territories. ... I would recommend that the names of the officers who may be appointed...be reported to the Surveyor General, and that he be directed to furnish them with instructions[3].

The following are typical extracts from the Surveyor General's instructions and criticisms.

You...allowed one mile in eight for the windings and inequalities of the road, but this is too much, as I have found from long experience. Indeed no surveyor should assume any arbitrary reduction...when he can ascertain from his own immediate observation the quantity...necessary. ... The windings of the road, ... should be observed at very short intervals if the road winds much; and a separate protraction upon a scale of one mile to an inch should

[1] SG'.s letter, 4-9-02; BMC. 28-4-03 (104). [2] Letter to Crawford, 15-2-04, DDn. 67 (480). [3] DDn. 81 (97-9), 14-11-07.

be made of each day's march before the General Plan is laid down [I, 187, 189]. In these particular protractions...one turn of the wheel in thirty may be subtracted for the inequality of the ground and the unsteadiness of the man who drives the Perambulator...in a tolerably level country, and 1/15, or 3/30 at most, if going through a pass or in a hilly country [I, 188]. ...

You should be particularly attentive to mark the boundaries of districts as often as you cross them, but the information of the Rayuts or villagers is best, as well as for giving the true names of the towns and villages[1]. ...

I used to allow 4 miles per hour...if going in a Palanqueen [I, 39], and 3 miles if marching without Guns. When a Halt occurs...all that need be done, when the distance is measured by Time, is to draw a Line across the Column of Hours and Minutes immediately on stopping, and to set down the Time again on setting off[2].

A correct military, as well as Geographical, survey should be made of the Route. ... For this...observe everything on the Road, or that is visible from it, which can be considered as of any importance, but particularly...Forts, Hill Forts, remarkable peaks, mountains or Hills, Ghats or Passes, Towns, ... villages, ... etc. ; Rivers or Nullahs, with their names, and noticing the way the stream runs, whether right or left, at the crossing place ; their breadths and directions as far as visible, up and down the stream. ... All Jeels, Tanks, and wells, should be laid down, ... and the quality of the water should be mentioned. ...

The boundaries of States or Provinces should be noticed, and...the sources of the rivers and their confluences with each other. ... The bearings of the Road should be observed as frequently...as possible ; as often at least as you stop to note the distance, or to take the Bearings of any other remarkable objects [I, 183].

Should you be in possession of a good sextant, and understand the method of observing the Latitude by Sun or Stars, a few good observations, taken with care at the principal places on your Routes, would be useful[3].

It might be attended with advantage your making every enquiry, not only of the natives, but of the Hircarrahs and Cossids employed throughout the country by the Commanding Officer [I, 286; II, 48]; and, when you think you might depend upon your information, to lay down the places in red ink, to distinguish them from those obtained by actual survey[4].

The following extracts are taken from fieldbooks.

The Kos of this country is in length 3000 paces, which at 30 inches a pace, is equal to one mile, 3 furlongs, and about a third of a furlong [I, 247]. ...

I intended to have made some enquiries relative to the trade, revenue, & Population of the Chief Towns. I desisted the temptation under the supposition that it was neither expected or required of me. ...

Variation of the Compass observed on July 23rd 1806 and found 3° 9′, and again 1° 44′ 41″. Much reliance is not to be placed on the above, ... the magnetic amplitude having been taken by a small compass, the card of which was about 2½ inches in diameter, and so old and mutilated as to render dubious the exact degree shewn by the needle[5].

The road bearings are in general taken from village to village ; the line of collimation cutting nearly the centre. ...

In general I deduct 1/16 for horizontal distance from station to station ; I have found by a number of trials that more...ought not to be deducted. I have ascertained this by Latitudes where the routes have been almost directly North [I, 183][6].

Surveyed with a screw Perambulator and pocket compass, with the exception of a very short distance which I was obliged to pace, in consequence of the Breaking down of the Perambulator. ...

When the road did not wind suddenly, or the openness of the country allowed it, I took long Bearings, contenting myself with being within a few yards of the road.

For variation of needle, I observed the sun's amplitude on the morning of 21st May[7].

Surveyors working in the Himālaya foothills put less reliance in perambulator measurements, and in his work between Sirmūr and Garhwāl Blane checked frequently with latitude observations ;

I very fortunately every day but one got a latitude &, as the observations were all made with one of Troughton's circles [230], I have great confidence in their accuracy. They were indispensable ; it is not possible from the steep ascents and descents, and from the excessive

[1] Colebrooke to White [59], 27–5–06 ; DDn. 67 (464). [2] to Wiggins, 18–5–05 ; DDn. 67 (372). [3] to Roberts [52-3], 15–12–06 ; DDn. 81 (45). [4] Crawford to Tickell, 5–1–14 ; DDn. 131 (10). [5] White, 1805–6 [59-60]; MRIO. M 343. [6] White, 1809 [63-4] MRIO. M 345. [7] Herbert, 1814 ; MRIO. M 541.

windings of the road, to apply the distances given by the perambulator without these daily checks [194][1].

In May 1808 the Military Board asked if the issue of perambulator for these surveys was justified by results, and the Surveyor General replied that several routes had come in "that proved very useful for promoting our Geographical knowledge of the Country" [197]. More useful, however, than the actual results of these simple route surveys was the incentive which led a few officers to become really skilled surveyors, as, for instance, Sackville, White, Webb, Hodgson, and Herbert.

BENGAL SURVEYORS

Although in exceptional parts of the country, such as Bundelkhand, it was occasionally possible to make use of triangulation, the great majority of Bengal surveyors had still to rely on traverse by theodolite and perambulator, with frequent observations for latitude. Some continuity of method was obtained by occasionally attaching young assistants to the more experienced surveyors [I, 185], but there was still no school for surveyors, and of course no professional handbook, and the Surveyor General had to send out lengthy elementary instructions to each new surveyor. The following extracts apply to surveys other than simple routes.

As...sufficient information...is seldom attainable without diligent enquiry as well as observation, and it is difficult...to obtain the desired information merely by interrogating the common natives, I would advise you to apply at each place...to the head man of the cutcherry...as to the following points.

First, the name of the town or village as it is written in the Persian, Nagree, or Bengalie characters. 2ndly, the Name of the *Zillah* and *Purgunnah* to which it belongs. 3rdly, if the capital of a purgunnah, the number of villages, with the names of the principal ones, dependent on it. 4thly, ... The distance to which his Purgunnah extends in every direction, and whether any of the places within sight belong to any other Purgunnah. 5thly, ... the marks by which the boundaries of Purgunnahs are denoted, if any such be in sight. ...

You will have ample time, on coming to your ground, to lay down your track for each day, which should be done upon a scale sufficiently large to admit of the insertion of every particular[2].

As I took it for granted that you possess every requisite qualification for surveying, I have written nothing relative to that in my official letter. ... Your survey should be carried on chiefly by the theodolite, and...a few latitudes by the sun and stars would be very desirable. Frequent observations also for the variation of the magnetic needle by the sun's amplitudes or azimuths are indispensably necessary. ...

It is highly useful to take sketches of the...country, ... which you will find of great assistance in laying down your work. Also in taking a set of angles with the theodolite, it is sometimes...better to sketch the objects than to describe them in writing, in which case you set down its angle or bearing in its proper place over each [I, 187; II, 200]. This method is particularly useful where hills are in view, or a fort [86 n.6][3].

To Sackville in Bundelkhand [48–9] Colebrooke wrote that he was much pleased to observe the improvement you have made in the style of laying down and colouring your plans. ... In some the writing is reversed, that is, the South is at the top of the paper instead of the North, which is always attended with some trifling inconvenience in reducing, or applying a Survey to the construction of a Map, in which the North you know is always uppermost[4]. ...

The intention of having the scale in Inches, or in parts of Inches, to English miles...is that the plans may be the more easily reduced from the largest scale that is used for Topographical plans, down to the smallest scale that is used in this office for any Geographical maps, which is 16 British miles to an Inch, or 1/16 of the scale...on which I could wish to see all surveys laid down.

For your general plan I would recommend the half, or 2 British miles to one inch, in case your present survey should not prove very extensive; but if it should, the scale of 4 B. miles

[1] DDn. 136, 3–4–15. [2] to Fleming [13], 24–4–01; DDn. 67 (37). [3] to Smyth & Macdougall, [27], 9–10–02; ib. (141). [4] ib. (389) 10–8–05.

to one inch would answer very well, provided you could retain all the villages and everything worth inserting. ... The cultivation, topes, and jungles (unless the latter are extensive) need not appear in a map of that scale, but everything else, and in particular the Boundaries of States and Provinces, etc., are essential[1].

To White he sends

some examples of similar protractions which I made upon a survey of Lord Cornwallis's marches in the Mysore country [I, 187], which I hope will shew you more particularly the method, ... as well as the style and manner, of representing objects in a Military or Topographical Survey ; [I am] glad...to find that the Bearings of the Roads are given in degrees of the Compass instead of whole Points, and that your offsets to villages, etc., appear to be pretty numerous and correct[2].

Garstin writes to Tod [55],

Permit me to remark, without being offended, that a little more care in writing the names of places, rivers, etc., in your public letters[3], will render them much more valuable. Your handwriting is a very good one, but in several of the epistles the character is so small, and the letters so run the one into another, that the names of many places must be guessed at. In your maps this is corrected ; they might miscarry and the letters alone arrive safe ; it is only writing a little slower to render everything intelligible. ...

I will...send you a skeleton projection of those parts of the General Map begun by the late Colonel Colebrooke, that will take in the surveys you have made. ... If you can...reduce the surveys to that scale, it will be a very useful employment, for...such a reduction must be better done by the person who has made the actual survey than by any other[4]. ...

You will always draw a meridian, or North and South line, to the North Point. The scale of chains [66 feet] is not used in this country ; if you mean a chain of 100 feet it should be so expressed. The chain used by surveyors in Europe answers well to lay down estates in Rods, Poles Perches, and acres, etc., but not for extensive surveys. We also require a scale of Geographic miles[5], ... and also to shew the coss, or Koss, of the country, stating the number contained in one degree. ...

Do not paste on small scraps of paper which easily come off and are lost, are less portable, and are extremely inconvenient for reference, but when necessity requires it add another whole, or half, sheet, pasted uniformly from top to bottom[6].

To Hodgson Garstin writes,

Excuse my pointing out to you the advantage of taking more pains with the map you draw. ... Copy some of those in Rennell's Atlas [I, 229–30] ; ... the map of the environs of Dacca, and that of the Cossimbazar Island, are excellent examples ; a little practice at printing makes it easy, and it is a very great recommendation to see the printing done neatly[7].

and to Blake ;

You ought carefully to measure the Breadth and depth of every river or stream, to note whether they are rapid or not, and the nature of their bottoms. ... Note all information obtained from others in red ink, which makes those who are to use it cautious, and prevents an illicit reliance being placed on uncertain information. ...

One General and indispensable rule must be invariably observed, viz., never to let your protractions or journal get one day in arrear. ... If you understand astronomy...determine the Latitudes and Longitudes of principal places from observations[8].

Crawford describes the principal points fixed during his survey of Mirzāpur as

mostly Hills, because I have been on the top of most of them, from whence I carried a series of triangles on all the others, all the way to Rotas[9] ; from whence I connected back again. My encampments were all laid down from the Route, corrected by three triangular bearings, and these again by the latitude taken every Noon, and many observations every evening by the stars[10].

He writes to Franklin who had just been appointed to extend Sackville's survey of Bundelkhand [51] ;

The greatest advantage will be derived from your taking as many Bearings as you can from the tops of any hills that may be in your neighbourhood. In taking angles and bearings in Hills, *always* draw their outline in your Field Book, & over each mark the angle taken ; and again, if possible, the names of individual Hills or Mountains, as they often serve to corroborate your work [199].

[1] DDn. 79, A, 11–7–05. [2] DDn. 67 (456, 464), 17–5–06 ; 27–5–06. [3] His *private* letters are even more difficult to decipher ; DDn. 130. [4] DDn. 81 (65), 8–2–09. [5] 60 Geographic, 69½ British miles, to a degree [I, 247]. [6] DDn. 126 (33), 31–5–10. [7] To Hodgson, DDn. 81 (174), 19–12–09. [8] To Blake DDn. 126 (146), 25–4–12. [9] Rhotas, 63 P/14. [10] To Smith [47] DDn. 135 (24), 23–11–13.

If you have a good Chronometer and could accurately keep her Rate by equal Altitudes, it would be of the greatest consequence to correct your Eastings and Westings[1].

Franklin ran primary triangles where the country was suitable, connecting at several places with short measured bases, and checking by astronomical observations. The primary triangles were filled up with secondary ones,

of such an extent only as enabled the surveyor from the tops of hills to see the whole tract included within their respective areas; thus none but ruined villages, of which no vestige remains, can have escaped notice, and every part of the tract laid down in the map has passed under his view; the hills are delineated with topographical exactness, the streams are accurately traced from their sources to their conflux, and the windings of the great rivers, so essential to geography, are portrayed with undeviating fidelity[2].

Marginal notes in Hodgson's hand, written when he was Surveyor General many years later, state that particulars of the triangles had not been preserved. They had probably been protracted by bearings and computed distances. Writing in 1850, Andrew Waugh makes no reference to any triangulation at all;

Although...it was wholly unconnected with the great trigonometrical survey, ... its errors were in some measure checked...from astronomical observations. Therefore, next to the great trigonometrical and revenue surveys, this is certainly one of the best and most detailed geographical documents we possess[3].

Lambton himself told Franklin that the survey was

precisely of that description which I wish to connect with my operations, and you may rest assured, If I live to extend my measurement towards the point I contemplate, I shall not fail to connect it when I pass through the field of your useful labours[4].

In the Sundarbans, under very different conditions, the Morrieson's straddled their wider rivers and creeks with chains of triangles rather than traverse laboriously along the soft mud banks[5].

Crawford, being a zealous surveyor himself, was very critical of fieldbooks, and writes to Blake [35];

In consequence of the papers in the office being much in arrears, and having had an Extra run of business since the arrival of Lord Moira [40 n.10], I have been prevented till now from looking over your Field Books. I have now examined them...and have it much to lament that they do not meet my wishes.

In the first place, your rate...is but a little more than 4 miles a day; and your angles nearly in the same proportion. Now, 4 miles and 4 angles a day cannot sure be supposed proper surveying. Major Rennell, ... who is justly held up as the best authority, insisted on the Gentlemen employed under him to survey from 10 to 12 miles a day, and I certainly think it ought never to be at a less rate than 7 miles.

After noting other omissions, Crawford continues;

You never pass through any town of any extent, else you would note in your Field Book "entered such a town—came out of it". After you arrive in Camp, you never take a range round your tents, either to get a better knowledge of the country, or to obtain the situation of distant objects by triangles, for the Perambulator always commenced next morning as you left off the evening before; indeed I do not see a distance by triangles in the whole of your tour; you surely must have often been within sight of the first range of hills, & yet I see no attempt to obtain any of their relative positions. ...

At the rate of four angles a day, each angle comes to exactly six Rupees a piece on the allowance of Rs. 618 per mensem[6].

One of the most conscientious and enthusiastic of surveyors was Hodgson who, after surveying various routes with his unit in Hariāna and other districts beyond the Jumna, was appointed assistant to White in the Upper Doāb [37]. The following are taken from his fieldbooks and letters of 1813;

Compared the going of the Perambulators on a line of 5 chains of 100 feet each; ran the wheels back & for'd. 16,000 feet. New wheel gained 64 yards, old wheel 131 yards. ...

Between Guraisur & Awa the axle of the wheel got loose & gradually lost distance; I was unable to measure this distance or to determine the relative length of the station, not having a watch with me; the distance in Koss is equal to about 7 m. 6 fur., road measure, from Guraisur to Awa Fort, & I measured 3 furlongs. ... I was obliged to estimate the Distances by

[1] DDn. 135 (21), 6–11–13. [2] Journal, DDn. 166. [3] *PR.* (37). [4] probably at a meeting in Calcutta early in 1820, *EIMC.* III (100–2). [5] MRIO. Misc. 2–0–14, a magnificent paste-up, scale 2 m. to inch. [6] DDn. 131 (57), 11–5–14.

the watch from Awa to Jellaisur[1], which I found to be correct, for, having well repaired the wheel, I measured the distance again. ...

From each station I take the Bearings of all villages, &c., in sight, calling 360° North, & so going quite round the limb of the theodolite; thus 100° will be E. 10° S.; 260°—S. 80° W., and so on. This method, recommended by your long experience, I find to be much more convenient to the Surveyor in the field, & to the draftsman or protractor, than the common one of writing down E. 10° S., as in that way it is not uncommon inadvertently to read off, or write down, S. 10° E. for E. 10° S., & the like, or make other mistakes by employing more letters & figures than by this mode; where the figures can answer *one bearing only*, there can be no ambiguity.

Very few distant places can be seen from the road on account of the mango Topes, but I always get upon any high Fort, Mosque, or other rising, & then get a view of more distant places. ...

The distances are measured by a perambulator made by Adams, which is true, but is occasionally proved on a measured line of a furlong on even ground, & run back and forward to the amount of a mile or more.

For the direction of the bases, I take the bearing of some well defined object at the station which I have left, which gives of course the opposite bearing, or the line forward; if there is no such object back, I leave a man with a flag mounted on a running camel, and when I fix the theodolite, I take the direction of the flag he holds up, &...signal him forward to occupy my place, & then proceed to the next station; 3 of these camels would be most useful. ...

I expect soon from England a valuable Bordas Repeating Circle; the Proceedings of the Grand English Survey by Col. Dalby[2], & on the French Grand Meridional Arc by Mechain & Delambre [249], with other Insts., Books, etc[3].

The Surveyor General writes to him;

Do not follow your predecessor's plan of sending down paltry scraps; reduce the whole to *one* general Map, on the scale of 4 miles to an inch, and keep your work up as well as you can; your unavoidable arrears can be brought up in the rains[4].

Surveyors make occasional slips, and Blane acknowledges a blunder made in the protraction of his survey of Sāgar Island [16];

In consequence of the error respecting the *variation*, I have been induced to lay down a second time the whole of my survey. ... By making the Magnetic North *east* of the True North, the triangles agree so exactly with my Latitudes, that I cannot refrain from transmitting you by General Garstin the result of my labor. The protraction of the small creeks correspond likewise delightfully. Both squinted a little & required some adjustment, very much to my mortification, in the map which I delivered in[5].

This contretemps well illustrates the great disadvantage of having no single master control on which every individual survey could be based. Until the coming of the Great Trigonometrical Survey to Bengal, each separate survey was an isolated effort that could only be fitted into its place by the doubtful agreement of its overlap with neighbouring surveys or existing maps, and by the approximate accuracy of a few astronomical observations. In order, for example, to determine his longitude for the route of Ochterlony's advance to Mukwānpur in Nepāl [43], Lindesay had to extend his route nearly 100 miles to the *gola* at Patna, which was one of Reuben Burrow's fixed points [I, 161][6].

LEVELLING

In the frequent references to levelling operations, whether for irrigation, drainage, or other purposes it is generally assumed that levelling was a simple process, understood by every engineer officer [308]. The Surveyor General writes of the levelling of Calcutta [17];

The art of levelling, like that of surveying and practical astronomy, requires great practice and skill in the person who undertakes the employment, and he can seldom derive much benefit or advantage from any other persons who may be appointed to assist him. ...

He should be furnished with a levelling instrument of the best quality, two levelling staves or poles and an hundred foot chain. ... His establishment of Lascars or coolies for carrying this

[1] in Etah District, 54 I/7. [2] Isaac Dalby [I, 165 n.1]. [3] Fdbk. 12/31–5–13, MRIO. M 347. [4] DDn. 135 (32), 2–12–13. [5] DDn. 136, 24–7–14. [6] Fdbk. M 447.

apparatus need not of course exceed six or seven men, but if the staves he uses are upon the old construction with sliding indexes, ... he should have two persons to assist him of superior capacity to the common Lascars, and it might be necessary...to employ two European assistants; but whose salaries need not in any case exceed 50 Sonat Rupees per month each.

As the adjustments and practical use of the levelling instrument are the chief difficulties, ... and the Engineer or practitioner who performs it should possess a tolerable share of Mathematical knowledge, ... he should be very liberally paid, but...his establishment need not exceed what I have mentioned. If a junior officer of Engineers be employed to assist in taking levels (and...such should be...encouraged to learn this branch of their profession), ... his allowance should be equal to that of an assistant surveyor, viz., one hundred Sonat Rupees per month[1].

White thus describes how he took levels for a new connection of the old disused Delhi canal with the Jumna without proper levelling apparatus [67];

I prepared two station staffs about 10 feet in height, which were divided into feet, inches, and tenths of an inch; to each staff was fixed a vane having a spring to it, to make it adhere to the staff in the position required. In the middle of the vane was a drawn-on horizontal line, 4/10ths of an inch in breadth, painted white, to be cut by the wire in the telescope.

A person whom I called my first assistant took his station on the bank of the canal or Jumna, and the 2nd assistant placed his staff at a proper distance in the direction I was to proceed. My theodolite was placed in the centre between the two staffs, which prevented...any allowance for the curvature of the earth, the errors mutually destroying each other.

Having properly levelled my theodolite, I directed the first Assistant to adjust the vane agreeable to the level, by moving it up & down until the wire of the telescope cut the centre horizontal line of the vane. ... The telescope was then turned to the 2nd Assistant for the same purpose; I then noted the height shown by each vane. I thus proceeded to the object, taking care to keep the assistants in their proper places by making the first take the ground of the second, and thus keeping him always between me and the Canal or Jumna, and the second always between me & the object to which I was proceeding[2].

MYSORE SURVEY

Mackenzie's survey of Mysore was carried out on entirely different lines to any Bengal survey, and was organized more like a modern topographical survey. Definite areas were allotted to each assistant, and each had a staff comprising a few boys from the Surveying School, and sometimes an interpreter, a State official, and a squad of lascars.

Each assistant first measured his own base-lines, triangulated his area, and ran intermediate traverse lines, whilst Mackenzie, as Superintendent, in addition to covering definite areas of his own, saw to the linking up of all the triangulation. Though each assistant was left free as to his methods of laying down boundaries and topographical details, these were generally fixed by rays taken from trigonometrical and traverse stations. The plane-table was not used. Mackenzie issued instructions from time to time regarding the scale of protraction, the style of drawing, and the statistical information that was to be collected.

MYSORE SURVEY, BASE-LINES

The surveyors had none of the special apparatus for measuring base-lines that was used by Lambton, but took elaborate precautions to ensure as much accuracy as possible. Arthur thus describes the measurement of the base-line at Harihar in August 1800, the start of Mackenzie's survey of the north-west boundary [95].

There being in the vicinity of this place several remarkable points...from which a series of Triangles may successfully be carried in any direction, ... the Measurement of a Base here...

[1] DDn. 67 (375), 27–5–05. [2] Fdbk. MRIO. M. 344. Oct. 1807.

was very desirable. ... I accompanied him [Mackenzie] on the morning of the 13th August to look out for the most eligible situation. ...

We began our examination on the summit of a rising ground, ... and here fixed a picket and Flag in a line with two trees south of us ; measuring from this in their direction (nearly North) with a Perambulator, at the distance of one mile another flag was stationed to assist the eye in readily finding the first. We now proceeded to an ascent where it was proposed to fix the North extremity of the Base ; the whole distance as found by the Perambulator was upwards of two miles. ... The soil is black and a good deal cracked, ... the surface rather uneven, but...free from irregularities of any consequence.

As...this direction would make good angles with the points...to be established, and the length could if necessary be increased to the South, we determined to...lose no time in commencing.

Measuring...from flag to flag by the eye being subject to latteral deviations which might affect the Base, it was thought expedient previously to mark a line, and small stones were judged the most proper for this purpose, as a line cut in the ground might be disturbed by the rains common at present, the soil being soft black mould[1].

Actual measurement was similar to that which Arthur employed on the Ballāpur base, described later [205].

Mather gives a long account of the base which he measured, for the start of his work near Hosur [96, 210]. He begins with a discourse on the general principles of survey ;

It being intended that the survey...above the Ghats, and bounding the Baramahl, should... be in some measure a continuation of that...upon which I had formerly been employed [I, 114, 194], it was therefore considered advisable to follow up the same plan of operations. ...

[Having chosen] three fundamental stations, ... and...such a cursory scheme of points as appeared most eligible for carrying on the process with correctness, expedition, and ease (leaving it to time, circumstances, and the progress of the survey, to point out what other inferior stations afterwards became indispensably necessary...), a proper situation was selected for measuring a Base Line.

Out of the whole tract it would perhaps be difficult to find a place of sufficient length for a Base in any one direction, which obliged me to lay...one out in two lines, forming an obtuse angle with each other, from which the two extremes were discernable, as well as from each other. ... The two extremities are pointed out by stakes driven into the ground, and piles of stones erected over them, and the included angle...embraces a remarkable large Tree. ... Every precaution that rule, reason, or experience, could suggest were particularly attended to.

The Base was measured with a chain of 22 yards, or 66 feet [200], the ends of which were fixed into the lower ends of two Bamboo Rods, shod with Iron, ... so that when stuck into the ground, the chain could be drawn sufficiently tense without risk of being moved from its place. ....

At what distances these bases of verification should take place depending so much on the nature of the country, and the...Triangles, calculations, etc., ... Time, and the communications of those who have had extensive practice and profess great professional abilities, alone can determine.

Without such precautions a survey, even though executed with the best instruments and by the most skilled practitioners, will in time be found to differ widely from observed latitudes and longitudes. ... Such a Survey, particularly if it consists of two or three detached parts, must be connected and finished before the scale...is determined upon ; and when a line of verification...is measured, and fresh operations commence from it, they should be connected by retaining two or three determined points common to both draughts; at least these are my Ideas, founded on a little observation and the perusal of some treatises I have met with[2].

Mackenzie had a great opinion of Mather's professional talents [101, 112], and considered his methods

more comprehensive of all we look for in a Survey (and on a regular System) than any I have met ; he does not pretend to the refinements of Science, but confines himself to what is immediately useful on a computed basis of stations, to which nicer corrections (which after all do not amount to much) may be at any time applied. ... I wish more of our young men would avail themselves of his method[3].

Arthur gives a detailed account of an elaborate measurement made near

[1] Journal, DDn. 44. [2] DDn. 44 (1-5, 8). [3] DDn. 66, 18-3-04.

Dod-Ballāpur to form a central check on the triangulation carried out by Mackenzie, Mather, and Warren [99–100].

The Survey of the Northern Frontier Boundary of Mysore...being now nearly completed after extending upwards of two degrees of Longitude from the original Base at Hurryhur, the measurement of another line became...necessary for the verification of this part of the work. ... A Base here would answer the double purpose of verifying the Triangles carried on from Hurryhur...and of connecting them with those in the S-East by the other assistants. ...

With this view Captain Mackenzie directed me about the 3rd of December 1801 to proceed from Sera to Great Balapore, and to remeasure a Base which Mr. Mather...had already measured in that neighbourhood. ... I arrived at Balapore on the 9th December, and employed myself in preparing flags, etc. till the 10th, when Mr. Mather...arrived. ...

Captain Mackenzie expressed a wish that it should be done in the same way as that at Hurryhur [95, 203–4], as nearly as the nature of the ground and circumstances would permit. On the morning of the 11th Decr. I went out with Mr. Mather to examine the ground...which, though not so favourable as could be wished, I found as much so as could be had...in this neighbourhood.

The place where the South end of the line commenced is about 2 miles...from Balapore in an open field, at this time under cultivation ; from here...over a swelling country, in some places crossed by broken hollow ground, ... close to the Edga[1] west of Balapore which, being a conspicuous object on high ground, was very convenient for readily pointing out the direction of the Line.

Near the north extremity the Base crossed the bed of a large Tank, ... dry during the former measurement...but at the time of the re-measurement it was full of water which we were obliged to avoid by long offsets, as was the case at all the hollow irregular pieces of ground that intervened. ...

The first thing to be attended to was the marking it out on the ground ; ... we judged that a number of small flags placed truly in the line should be sufficiently exact. ... We therefore commenced with this by placing a theodolite at a mark in the line, ... and setting its telescope in the vertical plane of the direction ; ... about the breadth of three feet was then cleared along the line of all impediments, and the corn, at present about 7 inches high, cut down within that space.

The chain used...was of the common kind, ... of 66 links each intended for a foot ; the extreme links were...fixed into two thin bamboos...shod with iron, ... having another point of iron 3 inches long at right angles to the bamboo and chain when stretched, to be used in hard ground. ...

The present length of the chain...was ascertained by stretching a small rope of twine between two iron pins driven into a fine stone terrace in front of the Mosque in the fort of Balapore, along which the length of the chain was marked (it being stretched in the same manner as when used in the field) ; ... then this length marked on the terrace was measured by two rods joined together, ... previously nicely ascertained to contain 20 feet 0.325 inches, by Mr. Mather's black wood ruler of 4 feet ; ... The chain was found to contain three lengths of these rods... and 5 feet 11.975 inches over, which by this ruler of Mr. Mather's gives 66 feet 0.96 inches for the length of the chain in 86° of Farhenheit's Thermometer. ...

By Captain Mackenzie's brass Ruler used as a standard at Hurryhurr...the chain was found to contain 66 feet .56 inches, which makes a difference on the whole base of upwards of 20 feet. This clearly points out the propriety of having a common standard for a work in which different people are employed. ...

The measurement of the Base was commenced on the 11th December, and...levelled in the common way by a very fine levelling Instrument, 18 inches long, by Wright.

Making several offsets to avoid bad ground they reached the *idgah*, and, continues Arthur,

after measuring and carefully levelling this far, I was unfortunately seized with an attack of fever...which...prevented our resuming...till the 30th December 1801 ; however...on my way to and return from Bangalore whither I had gone for change of air and medical assistance, I took a series of angles to connect the former Triangles with this place. ... On 30th Decr. we resumed the measurement. ...

The Base was divided into 32 sections, each of which was once measured and levelled at the same time, and the degree of heat observed in order to reduce the measurements to the temperature in which the length of the Chain was ascertained. ... The Base was gone over

[1] Muhammadan praying platform.

a second time with the Chain, all at once, but no sensible difference was observed from the first measurement which, to prevent any mistake in counting the chains, was also made in a cursory manner by a Perambulator. ...

The Meridian at the Base was determined by taking the Sun's amplitude when setting [I, 151; II, 208]. ...

To compare the measures...with some good standard is all that remains...and...there will appear very little reason to suppose that the most improved mode of linear measurement would make much difference. ...

The offsets from the Base, being all at right angles to it, ... taken with the utmost care, there is little cause to doubt that a line joining their extremities is of the same length as that part of the Base to which it is parallel, ... particularly as the offsets were always found to correspond within a foot of each other[1].

Several other bases were measured to Mackenzie's satisfaction, and he writes to Morison on one occasion ;

So you are astonished at your work differing 5 feet with Mr. Arthur's, measuring on rough ground by a common chain, with different standards. I should have been surprized had they agreed nearer[2].

Several years later, Arthur describes his measurement of a base in Travancore by means of wooden rods ; the standard used was a brass two-foot ruler made by Watkins of Charing Cross ; the base was levelled and gaps across rivers were calculated.

We had begun to re-measure the Base with another multiple of 90 feet, when we were deluged by the floods, which afterwards increased so much that all our instruments, which we were forced to leave on the ground, were carried away, & this necessity & bad fortune compelled us to be content with one measurement instead of two as you ordered[3].

MYSORE SURVEY : TRIANGULATION

Mackenzie extended his triangulation from the base-line at Harihar simultaneously with his survey of the north boundary of Mysore. He had no time for reconnaissance in advance, and when his triangles were held up by bad weather, with hill-tops enveloped in monsoon cloud, he broke off and continued detail survey or computations till better weather came. He frequently found it impossible to erect the instrument on the exact spot observed [97], and Arthur notes that in work such as this,

carried on with our common instruments through an unexplored country, where often distant points, ... taken up at random...were, when viewed in a different position, no longer recognised, the results are never found to correspond with theoretical conclusions[4].

Mackenzie himself writes to Lambton that,

Regarding these stations of mine to the northward, you will find the names of the places are given from the information of the people on the spot ; in the course of so extensive a survey, when we were...without time to reconnoitre the country deliberately, it often appears that we could not place an instrument on the very point observed...from the former stations ; for instance at Pennaconda, where a tree, the object, is situated among rocks that could not be approached within 40 or more yards.

This circumstance will account for some difference which may be yet remedied now that the country is known ; there are several of these stations that cannot be ascended with large instruments, but are too good landmarks to be omitted, but the differences on the whole, from north to south, go nearly to counterbalance each other[5].

He was however entirely satisfied with the work of the first two years and on the Termination of a Complicated Survey founded on 212 Triangles, carried on from the Shore of the Toombodra to near the Cavery at Alambaddy [100], ... a tract the greater part of which was known but by name a few years ago to our most intelligent Geographers.

On due consideration of...the nature of the Instruments used, of a common description & not minutely graduated...—a Series of Triangles originating from a Base measured at the distance of 140 miles from that of verification...—Stationary Points were generally

[1] DDn. 44. [2] DDn. 66, 17–6–03. [3] to QMG. ; MRIO. M 106, 18–1–10. [4] Report on Ballāpur Base, DDn. 44. [5] DDn. 66, 25–3–04.

observed at a distance before it was possible to have access to establish stations on them—& allowing for all these Inconveniences—the Dispatch under which the Whole Process was carried on—the repeated interruptions & the want of necessary assistance for a great part of the time...—so near a coincidence at these Central Points may be esteemed a favorable testimony of the fidelity of the operations[1].

He kept in close touch with his assistants and writes to Mather ;

Let me know the probable cause of the difference between your and Mr. Warren's bearings. Did you allow for the variation of the needle in your base line ? He tells me the distances [sides of triangles] agree ; I presume therefore the difference of the magnetic needle is owing to the variation not being allowed for, which may be easily corrected. ... As soon as we meet you will have the use of my magnet ; meantime the angles should be taken without the needle, and the meridional line will be altered by corrected observations of latitude[2].

I have perused your remarks on the mode of surveying with satisfaction [204]. There is no doubt but the needle is the easiest, but as errors sometimes arise from the constant use of it, it is recommended by the latest systems of surveying to observe its variations, and correct frequently by these. I do not by any means wish to retard your operations by prescribing methods differing from those you have followed...and which I do not wish you to depart from[3]. ...

I am very glad you have made such progress with your base, and doubt not but the ground was the best adapted to the purpose. I will be glad if you take the remarkable hills or points on the boundary connecting with my surveys on this side, in order to facilitate a general combination of the whole ; for...the several maps of districts should be connected together by the leading stations common to both, and this will serve to verify them at the same time that the corrections (if any) arising from any other work [meaning Lambton's] may be then applied more conveniently...to a general map on a small scale [118][4].

In some places the magnetic needle was much disturbed ;

On our return from the first of these excursions of 13th August, the bearings were found to vary so much as to attract particular notice ; I therefore went again on 21st, accompanied by Mr. Arthur, & with four different Instruments found the needle greatly agitated, ... which we found to proceed from the Magnetic quality of the Strata of this point alone ; the specimens we carried away possess the repelling and attractive power to a great degree[5].

Mackenzie was not ashamed to consult Goldingham on a matter that he might well have solved by a simple diagram ;

As I find there are different opinions of the denomination given to the variation of the needle, which sometimes occasions a little confusion, in adding it to the bearings by some, while others deduct, I will thank you just to look over the inclosed, and let me know whether the variation is not E. 1° 10′ 19″, and whether any bearing of a place taken from thence, as for instance Bearing S. 11° 50′ 0″, should have this variation added or deducted. ... Excuse this, which I recollect enquiring about before[6].

Throughout 1801 there was a constant exchange of information with Lambton, and on several occasions, where discrepancies were found, re-observation put the matter right [100, 118–9]. Mackenzie was, however, so satisfied with the close agreement, that he closed his work without actually adopting any of Lambton's values [112].

Several of the Northern Stations & Points ascertained by Major Lambton's Survey, connecting and intermixing with our more Southerly Stations, ... afforded an opportunity of further verifying the sides of these triangles. ... Of 53 Primary Stations of this Survey, ... Forty-one differ from 100 to 200 & 300 yards—Four only differ from 500 to 600 yards—Eight agree from 2 to 5, 9,2 8, 30, & 79 yards.

The results were not, indeed, of a high order of precision. The two values for Warren's closing side differed by 1500 yards, but the mean differed only 250 yards from Lambton's value. The discrepancy between three other sides common to Warren and Mather were 33, 65, and 87 yards respectively [107, 119].

When it is recalled that no fixed mark common to both was placed on these hills, the difference will not appear great ; but when an equal coincidence is found with Major Lambton's, working with the advantage of a more deliberate process, the testimony of the accuracy of their work is highly satisfactory.

[1] Memoir, 25–5–03 ; DDn. 42. [2] DDn. 41, 1–1–01. [3] DDn. 66, 10–3–01. [4] ib., 9–9–01. [5] Memoir, 25–5–03 ; DDn. 42 (35 n.). [6] DDn. 66, 4–5–03.

Mackenzie concludes with a table shewing the common sides and discrepancies of his own, Mather's, Warren's, and Lambton's triangulation[1], and out of 72 common sides, "Discrepancies of 500 yards or over numbered 16, Discrepancies of 100 yards or less numbered 15" This was, of course, Lambton's preliminary triangulation of Mysore which was never embodied in his final results [236].

Morison [102] was directed to survey one *pargana* at a time, but to extend his triangles without close regard to *pargana* limits[2]. He tells of his work;

Marched from Madras to Seringapatam, as directed by the Superintendent, and arrived there on the 2nd November.

11th. Marched from Seringapatam, commencing the survey of the Great Road to Nangmunglam [pl. 11]; ascertained some points upon the island, and arrived at Kistraspattah at 3 o'clock P.M. ...

16th. Made an excursion to the summit of Nursuswamy[3] for the purpose of looking for a tract for measuring the base. Rain all day from N.E. ...

22nd. Marked off a short base at right angles to the great one, for the purpose of ascertaining the horizontal position of Malydeaur Betta.

23rd. Measured the last-mentioned base (length 9 chains) and took the levels of it; commenced the great base from the summit of Malydaur; ... Took the depressions...and measured the acute angles at the extremity of the small base, and extremity of the great one. ...

December 8th. Measured the angles at a small eminence near Malanholly[4] (where the natives told me Major Lambton had placed a flag, from which I concluded it was one of his stations), and at the summit of Hona Betta[5]; this last station is marked by a conical heap of stones. The day was clear and the angles measured to great advantage. ... I have reason to believe the point from whence I measured the angles this morning must have been within a few inches of Major Lambton's station, as I could trace the marks where three of the pins which supported this flag had been.

21st. Halted and employed computing and protracting the primary stations.

22nd. Commenced the survey of the boundary at a land mark near S—, traced it by B— and I—, and left off at a land mark. ... Distance measured 2 miles 7 furlongs, 170 yards[6].

Arthur's journal gives a further picture of day-to-day work in Mysore [107];

June 7th [1804]. Surveyed the Boundary to day, and closed this part of it up to the point...where the district of Mailcottah[7] succeeds that of Nagmungulum, and to the south of which I had already traced some miles of the boundary common to Muddoor[8] and Mailcottah. ...

Being here a few miles of Nagmungulum, where I measured the original base, and not having yet been able to lay down any of the new survey for want of a connection with the former triangles and the points now taken up, I determined to go thither in order to establish them from the stations near the base, & at the same time endeavour to obtain a few observations for the latitude, ... and for the variation of the needle (having obtained the use of a tolerably good one on purpose in Seringapatam), which I there could not do in consequence of the indifference of the needle of my theodolite. ...

June 8th. ... At sunset got a very good amplitude of the sun [206], but the succeeding night was so cloudy that I was not able to obtain the meridian height of any of the stars for the latitude, which I was at all events precluded from by a relapse of fever, which came on with severity. ...

August 10th. After establishing a station of the Arrajerry Hill, which is very steep and difficult of ascent, I crossed the country...to carry on a detailed measurement of the great road towards Bangalore, which was surveyed this far from Seringapatam by my apprentice [103] whom I had detached for that purpose as, having all the principal points already in the general Survey, I had no scruple in entrusting the intermediate detail to him, whom I had previously instructed and practiced in this kind of road surveying. ...

August 25th. Halt here to day to bring up some of the Calculations, &c., of the Survey, and found that the triangles lately added cannot be conveniently connected with those of the former Survey till I have an opportunity of again ascending some of the leading points to the Westward, from the difficulty when I was there before, and unacquainted with the ground, of knowing the points now taken up across the...confused range of hills lying South of Ramgerry. ...

[1] Memoir. 25–5–03; Appx. III. DDn. 42. [2] DDn. 41, 7–10–02. [3] Narasimhaswāmi Betta, 3,541 ft. 57 D/10. [4] Mallenahalli, 57 D/9. [5] Honna Betta, 3,028 ft. 57 D/9. [6] Journal DDn. 45. [7] Melukote, 57 D/10. [8] Maddūr, 57 H/2.

Sept. 8th to 28th. Having now finished the greatest part of the actual survey of this district, I employed myself...(with the exception of some days that I was laid up with fever) in calculating some of the Triangles...and arranging some other papers...partly furnished by the Circar Officers, and containing, among other points of information, a list of houses, families, and ploughs. ...

Sept. 29th. Having collected and prepared the greatest part of the papers...in the rough, and taken a sketch plan of the Fort, with a few astronomical observations for latitude and variation of the needle, I judged it better to go on with the actual survey during the present favourable weather than...to get fair copies made out. ... I therefore set out...to commence the survey of Hoolioordroog[1]. ...

Feb. 1st to 25th 1805. Having been obliged to alter the situation of many of the primary stations which form the ground work of the whole, I was consequently obliged to alter the detail, so that, ... I had a very considerable part...to protract over again before I commenced the fair copy, which...was not finished till the 25th. ...

Feb. 26th to March 25th. Employed in making out Tables of the Primary and Secondary Stations, and making a separate fair plan of the former ; in arranging Tables of the Villages and other heads of the Memoir. Calculating some observations for the Latitude and Variation of the Compass, and making Abstracts ; ... protracting the great road from Seringapatam towards Bangalore ; ... bringing up my Journal and laying down sketch Plans of the Forts Pettahs ; and getting fair Copies of the whole. ...

April 21st. Having received instructions to proceed to the Districts in the neighbourhood of Sera[2] to fill up some parts of them still unfinished, and to Survey in my way the great road from Seringapatam to Sera, I set out to day for that purpose, and traced the great road... about 10 miles in a general Northerly direction. ...

24th. Surveyed the great road to Beloor[3], and in my way ascended thus a third time Hathbetta, in order to obtain angles of the principle [*sic*] points in my route, to enable my laying down the road with correctness on a chain of triangles. ...

26th. Surveyed the road...fourteen miles to Cudduppa, in which I fixed several stations, but as it leads through a Champaign Country without any conspicuous points in front or on either side, I apprehend a good deal of difficulty in carrying on a connected chain of triangles satisfactorily, ... which however...I can readily do when I get angles from some of the hills to the northward[4].

When Mather was working towards the Western Ghāts [104], Mackenzie wrote from Madras ;

Be very particular in the Base ; preserve your memoranda of it ; have it well levelled and marked out. I will re-measure it with you when I go up, and I would wish all the triangles to be entered in a book by themselves, for re-computation afterwards.

Would you believe, there are people here[5] who would assert *we never compute* our distances ; for such, a contemptuous silence is the best reply to malice, folly, credulity, or selfish designs ; yet I am willing to preserve documents to convince at a proper time those who are competent to decide, and entitled to that attention[6].

To the west, his own triangles agreed well with Mather's ;

The results of three different triangles...agree within 32 feet, the mean of the three making only one of difference. The difference with yours is of little consequence, & need not occasion your altering anything ; they are no more than must arise from different instruments [118–9][7].

The following is taken from Dunigan's journal in Kanara [110] ;

March 7th 1807. Howel made a circuit of the country to the S. and W. and ascertained the positions of a few villages. ...

9th. Halted to protract the field work of the two last days, while the country people were employed in cutting the wood on the summit of Soola Mulla, the highest hill among a group in which I intended to establish a station, but when I ascended I was mortified to find, from the number of huge trees on its summit...that I was obliged to relinquish the thought of making it one of my primary stations, but content myself with another hill. ...

Descended at 6 p.m., when Howel returned after ascertaining the positions of 5 villages... in his circuit this day. ...

10th. Employed in the forenoon on the plan, and ascended Bulla Mulla to establish it as a station, being also a station of Major Lambton's [pl. 16], while Howel protracted the field work of the last three days. ...

[1] Huliyūrdurga, 57 H/1. [2] Sīra, C/14. [3] Belur, 48 0/16. [4] Journal ; GBO Lib. A b.85. [5] Obviously not Lambton or his assistants who had left Madras to cross the Peninsula in Oct. 1803 [238]. [6] DDn. 66, 23–1–04. [7] ib., 15–11–05.

12th. In my perambulations this day I fell in with a station of Major Lambton's...where I took a set of bearings and established a station. ...

26th. Left P— at 8 A.M. and proceeded easterly on a footpath gradually ascending as far as P—, a small village with a nut tope on the top of the Ghauts, where I halted, to have the necessary guides to accompany me to the summit of T—, a lofty Peak. ... I began to ascend about 11 A.M. and reached the summit at about 1 o'clock, being very steep and difficult. On my way up the hill I was surprised to see several large trees of an extraordinary size and length, which I was informed were cut down on purpose to shake the earth, and by that means admit the cardimon to grow.

The weather being very unfavourable for observing rendered it necessary for me to remain all night on the hill; ... constructed a little hut of bamboos covered with plantain leaves, to shelter myself from the dampness of the weather. I went to bed on a bare mat after making a hearty dinner, and with the assistance of my cloak (which I never failed carrying with me), slept pretty comfortably till about 1 in the morning, when I was disturbed by the wind, which blew my small hut down, and obliged me to sit up and warm myself by the fire till daybreak[1].

MYSORE SURVEY : DETAILED & STATISTICAL SURVEY

The main objects of the survey as set out by Mackenzie in February 1800, provided for a series of primary stations emanating from measured base-lines, and for detail to be "ascertained by correct bearings of the Primary or Secondary stations" ; statistical information was also to be collected [91–2]. Such were the orders given to Mather and Warren on starting out [93]; detailed instructions were to come later ;

Your equipment for the survey being now completed, ... you will...proceed as soon as possible to take a survey of the tract...in Mysore [here defined]. ... To enable you to acquire the necessary information...of the boundaries, ... I have this date apprised Colonel Close, Resident in Mysore, ... requesting him to direct the head managers of these districts to furnish you with such information or other assistance as may be necessary. ...

Meantime, having sufficient confidence in your abilities and zeal, ... there will be no necessity for suspending the commencement of your operations ; and, ... when you have made yourself sufficiently acquainted with the face of the country to choose the ground for the base of your survey, you will next proceed to select your principal points and stations, and afterwards to lay in the country in detail[2].

To Mather he wrote three months later ;

As you have had considerable practice in the actual survey of the Barramahal [I, 113–4], I wish to have your opinion of the most convenient scale to be adopted in plotting or laying down the survey. In a district 10 or 18 miles of a side, it might be difficult to lay down the whole with precision on a scale of two miles to an inch, and therefore that of one mile to one, or even two, inches has been suggested ; you will therefore oblige me by giving your candid opinion founded on your own experience. I should also like to know the method you took in measuring your first base, the length of it, and what time it took to complete [204][3].

On Mather's advice he decided on the one-inch scale[4], and wrote to Warren ;

As you seemed to think the scale of two miles to one inch was too small for protraction, I have no objection to your making use of another...provided it is of a nature to admit of being easily connected with the other surveys. Mr. Mather, who has had a good deal of practice, has chosen that of one mile to an inch ; as your surveys must be connected, it will save much trouble to yourselves and others if you can do the same. ...

Mr. Mather is desirous...that your and his bearings of such points as connect your surveys should...correspond ; you should therefore communicate with each other on this subject, or any other that may forward the service ; from his experience much advantage may be derived [204][5].

Again to Mather ;

I shall be glad to be informed, before you proceed to the coast, of the bearings and distance of Oosoor Hill and Anchitly Droog from Ryacotta[6], ... to lay them down in my general map. ... Also...the number of tanks in the Oossoor district, as it is a very material thing, not to be

[1] DDn. 48. [2] DDn. 66, 30–1–00. [3] ib, 28–4–00. [4] ib., 8–5–00. [5] ib., 17–6–00. [6] Rayakottai, 57 L/2.

omitted, and I observe very few in your map. I hope you will...distinguish as much as possible the hilly tracts from the plains, that the contents of each may be ascertained[1].

By October he had worked out full detailed orders [100], which he issued as *General Heads of Instructions for the Geometrical & Geographical Survey of a Purgunnah*, ... that they may all be done on one uniform plan [101, 108].

Previous to the commencement of the Survey of the Boundary of a Purgunnah, the Surveyor should have established...a certain number of Primary Stations connecting with each other & with the most remarkable points in the adjacent Districts; connecting with a Base measured with all possible accuracy. ... With these & such Secondary Stations as can be established...the situation of every village in the Districts should be ascertained.

The Ground Work of the Survey thus laid—the Exterior Boundary of the District should be next traced—the land marks of the limits ascertained & described ...—on the Frontiers of Mysore, a particular attention is to be paid to an exact adjustment of the Limits in the first place—the Interior Boundary of the Purgunnahs with those adjacent should next be noticed—those of the Interior Subdivisions may be gradually traced in the course of the work.

An account of the Boundaries & a List of the Divisions of the Purgunnah will be necessary ...also a List of every Village under each Cusba or Capital place, with the Tanks belonging to them & distinguishing whether ruined or not. ...

In...tracing the Boundary & proceeding from one Station to the other, the Cusbas, Forts, Towns, & Villages coming in the way, or lying on either side, should be laid down by Angles with the Stations, or adjacent fixed places; others may be taken by occasional excursions.

A particular attention should be paid to the Lakes, Tanks, Reservoirs, and other Waterworks useful to the Cultivation; these may be sketched in & the Courses of Rivers, Nullas, their Sources & junctions when within the District; the Fords & Passages of the Greater Rivers marked. Mountains & Hills. ... Passes & Defiles. ... Villages in sequestered places. ... Villages lying beyond the general area of the District. ...

The results...should be protracted or laid down in a Map as nearly as possible &...opportunity should be embraced of correcting the positions by observation; the Variation of the Needle should be observed from time to time.

As the adoption of one common scale is useful for connecting more readily the Surveys of the Several Districts, that of One English Mile to an inch is recommended for the Provincial Maps of the Districts.

The Names of the principal Cusbas; those of the inferior Divisions & the Forts should be distinguished either by the mode of writing them, or some marks of reference[2].

To Warren he eleborated these instructions;

Taking your enquiries in the order they stand in; ...

1. The *scale* to be adopted for the plans of the Purgunnahs...is one British mile to an inch. ...

2. A *separate map* of the primary stations, etc., will very properly accompany the conclusion of the whole. ...

3. The *principal roads*, the courses of the rivers, and the boundaries of the interior divisions, should be inserted with as much correctness as possible; ... much of this...in your progress from one station to another. ...

4. *Tanks*. In the first stage of a general survey...it is not convenient...for ascertaining with geometrical precision the actual contents of...each, any more than the square contents of the cultivated land of each village, as that belongs to a *particular minute Agricultural survey* [92]. I would therefore recommend...your laying down every tank in its position near the villages, sketching them off with as much accuracy as the time admits of. Such of these as lie near roads may be traced along the extent of their banks; the quantity of land they occupy, or water they contain, depends much on the rains of the season. ...

5. The *Computations* appearing in your field books are not wanted immediately; but at the conclusion of any considerable portion these documents will be useful...to authenticate...the several charts formed from them.

6. *Deserted Villages, New Villages, Villages in Jungle*. It will be necessary to notice villages contained in the official lists...or any alterations that may have occurred...to assist Revenue management. Ruined or deserted villages may be denoted by a star; ... new villages not in the list should also be distinguished; Villages in jungle should be ascertained with as much accuracy as their situation can admit. ...

7. All *Woods*, inaccessible jungle, and Hills, should be noticed, and their extent from without ascertained as nearly as convenient[3].

[1] DDn. 66, 7–7–00; DDn. 41, 15–7–00. [2] DDn. 42; Appx. 5. [3] DDn. 66, 5–9–1800.

Mather fixed his detail, either by intersection, or by resection from three known points ;

The nature of the country...determined my adopting the same plan of operation I had pursued there [Bāramahāl], as being...sufficiently correct, and of all others certainly the most expeditious ; ... laying down subordinate villages, and bendings of Boundaries, Rivers, Hills, etc., by Magnetic Intersection, and those of more importance by the angles between 3 stations.

In a level and open country, where there is no great risk of the view being interrupted, the Angles between any three Stations...may be adopted with success, and the observations pretty expeditiously laid down, but...such a process depends, not as by the needle on one intersection, but on the accuracy of several intersecting lines, ... unless executed by some instrument such as a protractor with moveable radii. ...

In establishing some of the principal villages in the open country...by angles between three stations, ... they had been laid down by drawing infinite right lines equal to the observed angles on a sheet of strong transparent paper, ... which, when laid on the Map, and moved about so as to coincide with the points observed, shews the station or place of observation accurately and expeditiously [228][1].

When the process by angles is adopted, ... every general purpose would...be equally well answered by only so establishing the Cusbas of Districts...and other remarkable places necessary to be shewn...on a reduced scale ; and the smaller cottages by the bearings from any two places so determined, or by intersections of the Needle from the nearest stations. ...

In the accompanying Map, every individual village is not laid down by observation, it often falling out so that 1, 2, or even 3, of them be so contiguous to the...station, that their situations may be easily determined by their bearings therefrom, and their distances estimated by the Eye. ...

Attention has been paid to laying in all the Tanks, ... either by their bearing or estimated distance from the nearest village or, if too remote to do so, by intersections on their banks, and, as no colouring or description can so effectively point out the general tendency of the country...as the drawing in carefully the Rivers, Rivulets, and Brooks, they are here on that account pretty correctly represented. ...

The very large scale on which the survey has been carried on, and the Map constructed, has in a great measure prevented many little inaccuracies, which those on a smaller one are liable to[2].

In reply to a query from Warren, Mackenzie writes ;

No alteration in your style of colouring occurs to me, as I consider every person is best left to that he is used to. ... In a map of a purgana or District, references or explanations will be useful...and to render yours uniform with the rest I enclose a paper containing those generally used with us, which, or something similar, I would also recommend to you[3].

Morison gives the following description of a day's work [102, 208] ;

Attended by people from P— and N—, I went to the boundary immediately south of B— from whence I understood it came in a straight line. The perambulator could not be used from the thickness of the jungle, but I ascertained five stations upon the boundary between B— and the next landmark, which was ascertained upon the 17th ultimo. By these stations several deserted villages which are situated among the jungle were determined. The whole of the boundary having thus been completed, I struck off towards C—, and took flying stations near it to ascertain the deserted village I—[4].

Each surveyor compiled the maps of his own area ;

The Provincial Maps...of the Districts...are to be laid down on a scale of two English miles to an inch, which...is sufficiently large to admit all the villages, tanks, and leading features of the Country. This is to be understood of the plans protracted from the actual survey, and expected for the several Purgunnas as completed. The smaller plans...will...be reduced from these[5].

Mackenzie wrote to Mather as the work approached the Western Ghāts ;

I understand that Major Lambton has another surveyor attached to him, and that the courses of the rivers will form a particular part of their attention [119, 237], but as that forms part of ours also in Mysore, I scarcely suppose it will be there encroached on ; a considerable attention to this subject will however be necessary, and the remarks made by you on the springs, sources, and courses of rivers, etc., will be particularly desirable [107, 111]. ...

[1] this method of resection described by Puissant, 1807. [2] DDn. 44 (15). [3] DDn. 66, 4–6–01. [4] Journal, DDn. 45, 11–2–03. [5] To Arthur ; DDn. 41, 1–3–03.

Let me know the square contents of each district in miles, and it would be desirable if you could annex to each an estimate of the square contents of hills, plains, etc.[1]. ...

The Winds might be marked down daily in a separate column or your Meteorological Journal ; the young men may be soon brought into a habit of noting these remarks [115].

When you Survey near the Ghaats, a particular attention will be requisite to those Passages to the lower Country, and for the most important Passes, particular plans would be desirable[2].

Dunigan writes of work in Kanara in 1807 [110, 209] ;

April 30th. The Survey of Mangalore District being completed, left S— and moved by Moolkee[3]. ...

May 12th. Having received instructions from the Superintendent to survey a small part in Coppa[4] unsurveyed last year, I found it advisable from the state of the weather to proceed immediately to that quarter. ...

14th. Swarms of large flies and leeches very tormenting to travellers and horses. I was advised by the country people to rub the heels and hoofs of my horse with lime juice, which they said would keep off the leeches from biting, which I did, and was surprised at the effect it had, for as soon as the juice was applied those that were sticking to the horse's heels immediately fell off. These leeches I understand dry up like a stick in hot weather, and as soon as the rains set in come to life again. ...

22nd. Went on J—n Betta to take a station, and ascertained the position of twelve villages...and returned to M— H— where Howel arrived after completing the N.W. part of the district. I was surprised at the sight of two wild buffaloes on the summit of J—n Betta, which ran precipitately down the hill at sight of us[5].

An important part of the survey was the collection of facts and statistics about the population and resources of the country, which were arranged in *memoirs* for each *pargana* [92–3]. Mackenzie explains the limited scope of these in a letter to the Resident ;

There are some heads of Statistic Enquiries which I have avoided ; ... without thorough Investigation little benefit could immediately accrue, & imperfect attempts in the course of... other laborious pursuits would embarrass & perhaps...impede the rest.

The *Population & Revenues* come under this description ; the former, as far as depends on the number of villages & generally of houses, I...form a gross calculation of ; to take an actual account would require the immediate interposition of the management, & the aversion of the natives to these Enquiries are [*sic*] well known.

Any Enquiry into the Revenues I consider...to require a distinct investigation of by persons qualified by habit & by knowledge of the languages. ... Though connected with Statistics, ... [I desire] those employed under me to avoid for the present these or any other subjects not expressly recommended[6].

Most of the memoirs contain interesting descriptions and sketches of agricultural implements. Mather's were specially valuable ;

Several of these have originated with himself, particularly the tables and mode of arranging every individual village by the Primary Stations, which in future will authenticate the survey, and the position of each in its proper district ; the classing of the several kinds of Lands, with the stock of cattle ; ... the Tables of Manufactures and of exports and imports, and the useful tables of Vegetable productions common to these countries[7].

Mackenzie set great store on the arrangement of village registers, and points out that the lists kept up at civil headquarters were based on ancient records, and had become misleading ;

In process of time the original names are altered in common use ; villages go to decay in one place, while new ones are built in others ; Hamlets assume the place of Cusbas ; and, ... as the original name is still preserved in the Register, a confusion is apt to occur and, from the difficulty of ascertaining doubtful places, concealments and frauds are practicable in the remoter Districts. ...

[In the new registers] the actual position of every individual village...according to the official Register furnished, is fixed by the nearest permanent landmarks, as Hills, Rocks, Rivers, and other villages and stations observed, so that no difficulty can well occur...in ascertaining the situation [111, 155][8].

Copies of triangulation charts and *pargana* maps are still preserved[9] ; most of them are very neat and particularly clear as regards boundaries and villages, but

[1] DDn. 66. 23–10–03. [2] DDn. 43. 22–1–04. [3] Mūlki, 48 K/16. [4] Koppa, 48 D/6. [5] Journal, DDn. 48. [6] DDn. 41. 24–10–00. [7] MPC. Dec. 1802. [8] ib. 16–8–08. [9] MRO. maps 193–234.

there is no attempt to indicate undulations of ground or details of hilly and wooded country. The following are comments made by surveyors of later years.

In 1826 Montgomerie writes of the survey of Bednur, or Shimoga ;

1 inch to a mile. Original Survey & first protraction ; ... surveyed in 1805–06, on a series of trigonometrical Triangles carried on from Ajumpoor [105, 107]. ... The Stations are marked with a black line under the name. It is apprehended that the Stations were laid down by intersection, so that one part of the work may be thrown out of its position with respect to the other. The detail appears to have been transferred from field books ; the slopes and hills are not minutely expressed ; the drawing is on common paper, which has been much pasted and a little torn[1].

In 1838 Campbell[2] writes of the Coimbatore–Mysore border as shewn in the ¼-inch Atlas of India, and drawn from Ward's survey of 1807 ;

On comparing the present sketch with that portion of sheet 60 of the atlas, marked on the Denkenicottah and Allumbaddy Talooks [100, 111], it will be seen how incorrectly the topography of this portion has been represented ; the elevated tracts of table-land being altogether omitted, or not properly drawn, and the boundary line is also incorrect, many villages near the point Deorabetta belonging to Darampoory being put down in Mysoor.

This part, I believe, was surveyed under the orders of Colonel Mackenzie, and the perambulator and circumferentor were the only instruments then used.

In the same sheet the inaccuracy of survey of Mysoor, as contrasted with that of Coorg, may be plainly seen near Periapatam[3], the boundary line being made seemingly to divide a broken and jungly district from the Mysoor which, although shewn as uninhabited, is drawn as if it was a flat country[4].

The weak points of Mackenzie's survey, as noted in these comments, were due, firstly, to the method of laying down the triangulated points, which were not computed in terms of geographical co-ordinates, but laid down graphically from the computed sides of the triangles, aided sometimes by angles laid down by protractor. Secondly, to the system of protraction from field books, and lastly, to the enormous area covered, some of which was surveyed by assistant surveyors under training, whose work it was impossible to examine regularly. The survey of Coorg referred to by Campbell was carried out in 1815–7 by planetable, as taught in the Military Institution [214–6].

The survey of the Ceded Districts between 1809 and 1814 [153–6] was carried on by the same methods as those used in Mysore, the assistant surveyors measuring their own bases and doing their own triangulation and computations.

A very complete Series of Triangles has been carried on throughout the Districts, derived from several bases, measured at different places about 100 miles apart. ... Such of the sides of the Triangles as coincide with those which have since been established in the same tract by Major Lambton have been found to correspond so minutely with the distances ascertained by him, as to afford the best proof of the general correctness of those determined by the Assistant Surveyors[5].

An interesting field book of Dunigan's[6], shows that detail was fixed from a series of interpolated stations, each of which was fixed by compass or theodolite resection from triangulated stations. Facing each page of observations is a hand sketch of the area covered by the day's work.

MADRAS MILITARY INSTITUTION

An entirely new school of survey was introduced into India by the founding of the Military Institution. The art of plane-tabling was brought by Troyer from his military training in Austria, and it was undoubtedly under his inspiration that Lord William Bentinck laid down the principles on which survey was to be taught [125].

The practical part of surveying with a plain table, though very simple in its principles, abounds... with nice observations, which practice and experience only can suggest. The mountainous

[1] DDn. 246 (78). [2] John Campbell, 21st Mad. Inf., in ch. Salem Survey. [3] Piriyāpatna 57 D/3.
[4] DDn. 410 (54), 14–12–38. [5] From SG. to Govt. MMC. 26–8–14. [6] Fdbk. No. 5 ; Calastry ; MRIO. M. 49.

part of a country is seldom well represented, even in plans of some reputation. The cause of it is the not attending to the General Rules which nature commonly observes in the disposition of rivers and the cast of mountains ; the knowledge of the ground which gives to the plan the character of truth is to be acquired but by frequent surveys and close observation. In the practical excercises around Madras, where the ground presents a sufficient variety, frequent opportunities will occur of directing the young Gentlemen's attention to different subjects of that nature[1].

The start was happily timed just after Lambton had completed his first meridional series of triangles through a part of the Carnatic that was long due for survey. His triangles were broken down by minor triangulation by Troyer and his more advanced pupils ; the co-ordinates of the points were computed out and plotted on to the plane-table sections as described by Garling in his description of the Kālahasti survey of 1810 [127];

Latitudes and Longitudes were worked out by first referring them to the Meridian of Carangooly and the perpendicular through that station [259 n.2, 262–3], and afterwards by adopting the Elliptical Hypothesis as deduced by Major Lambton in a memorandum dated November 1809, transmitted to the Asiatic Society[2].

Lambton thus explains the table of projection which he had worked out for his map of the south peninsula [277] ;

There will be a table...giving the length of every degree of latitude from 8° to 14°, and the length of the degree of longitude to every degree of latitude, all deduced from the most accurate astronomical observations [260–2]. This is absolutely necessary in order to have maps or large plans constructed upon correct principles, for by laying down a certain number of great places or stations by these means, the intermediate spaces may be filled up in the ordinary manner by the triangles and distances[3].

To continue Garling's report ;

The Registers of the Triangles taken up in this survey...afford within themselves the means of estimating their accuracy. These Triangles have been filled up on a scale of 4 Inches to a mile by the following method.

The rectangles on the accompanying sketch are 4½ miles from North to South, and six miles from East to West[4] ; their position is due East and West—North and South—with respect to the Meridian passing through Major Lambton's station on Carangooly Hill. The several points determined in the Register of triangles have their perpendicular distances from the Boundaries of these rectangles strictly calculated.

A rectangle corresponding to those on this sketch having been carefully constructed on the Planetable, and the points which fall in it having been protracted by their known distances from it, these have been proved by trying the distances from each other. ...

Such points as have been determined by the Trigonometrical operations are marked on the Plan by small black rings ; those marked with red...the stations of the large Theodolites.

A reference to the back of the section will shew the name of the officer by whom it has been surveyed, and its position with respect to the sketch. The center of the section is the point intended in the Latitude and Longitude written at the back of each[5].

The survey of Goa was started on the scale of 4 inches to a mile, but, writes Garling,

The remaining parts...shall be done on a scale of two inches to a...mile, the Plain Table being used [156–8]; it may be done on that scale in nearly the same time it could be done on a less, and the advantage of giving room to express the detail is sufficiently evident. Forts or other objects which require to be distinctly expressed will be taken up on a scale corresponding to their intricacy or importance. ... The principal roads will be measured by a Perambulator as opportunity offers.

I...keep by me a sketch on one inch to a mile of the country that has been done ; this I shall have the honour of presenting on the completion of the Survey[6].

A base-line was measured on the beach near Cape Ramas with results that closely agreed with De Penning's base at Kumta [248][7] and

the Triangulation was extended from it by a fine Circular Instrument of 18 Inches diameter, and of the highest power [255] ; in the calculations, allowance for Spherical excess has been made ; the stations so determined are marked on the Map[8].

[1] Governor's Minute, MMC. 17–11–04. [2] Garling's Journal, MRIO. M 63. [3] Report to Govt., 24–7–10, DDn. 63 (221). [4] Each section 27 sq. m. [128]. [5] Journal, DDn. 96. [6] DDn. 127 (70–1); 3–9–11. [7] T.S. III (1). [8] DDn. 246 (99).

Co-ordinates were computed with reference to the meridian passing through the south end of the base and its perpendicular.

Garling's zeal for the high quality of his work was fully shared by his assistants, as witness this letter from Charles Dunn ;

In consequence of the error which has occurred in the Section South of Paroda, owing to a mistake of me in regard to the points, it will probably be deem'd necessary for that part of the Survey to be done over again. The work allotted to me ought to have been delivered in a correct state, & I feel anxious as far as lies in my power to obviate any detriment to the Survey arising from this mistake.

Being well acquainted with that part of the Country where the error has occurred, I would be able to rectify it in eight or ten days at furthest, whilst to another person it would take several weeks. ... No additional expence to Government would be incurred by this measure[1].

From Goa Garling moved to Sonda [158–9]. His military officers were replaced by sub-assistants trained at the Surveying School, though Conner was re-posted later to assist in supervision.

The survey is founded on the base measured in Goa in the year 1811 dependent on which a net of primary and secondary triangles have been extended from the adjoining frontier stations of Goa, and spread over the whole surface of the Soanda and Bilgy Districts, intersecting some points of geographical importance in the Mahratta country, and uniting on the sides of Mysoor and Canara with the stations and points of the general survey under Major Lambton, and the topographical surveys made of the two latter countries. ...

All the points determined by the triangles have been referred to a common point, the south end of the Goa Base, which point had preference on account of the observations for the meridian being taken at it. ...

The topography of the country has been taken up by the planetable on the scale of one inch to a mile. The table has been prepared by first drawing upon it the lines limiting the space destined to be taken by it ; these lines are always parallel and perpendicular to the meridian passing through the south end of the Goa Base. ...

All points...have been protracted in reference to those lines, and independent of each other ; the correctness of their positions has then been tried by measuring the distance between any two points, and comparing it with the known true distance, whence resulted the most prerfect check. A further check, ... again occurred in the field, by placing the table upon any one of the determined points, and looking that the other had a correct bearing from it.

From these trigonometrically determined points a variety of other were quickly determined. ... It has been repeatedly proved that but a moderate degree of attention is necessary in setting the instrument to directly obtain the strictest accuracy in relative position of station and intersected objects.

In some parts where the country is very waste and enveloped in jungles, and its surface nearly level, ... considerable difficulty...has prevailed in tracing the indistinct features of the country, and determining the long-since ruined villages ; the other parts...are generally executed with a minute correctness.

After describing the great care taken in surveying boundaries of administrative subdivisions, and distinguishing their names and principal towns, Garling proceeds ;

All roads extending from one frontier to another, and frequented as communications between one country and another, are distinguished by being shaded with a black line ; those leading from a frontier and terminating at any principal place within the district, or communicating between two or more principal places both within the district, are drawn with equal strength with the former but are not shaded ; it is only roads of either of these classes which have in general been noticed on the map.

All the roads of the first class have, without any exception, been measured with the wheel, and nearly all those of the second class also ; such more local roads as are of any particular importance, as communicating across obstacles such as rivers, ravines, mountains, etc., ... have a place on the map, but are made considerably less distinct[2].

JAVA

The following notes on reconnaissance surveys made in Java are taken from Baker's journal [137–8][3] ;

[1] DDn. 127 (290), 16–4–12. [2] DDn. 98. [3] IO Maps. MS. 24. There is a suggestion that this journal is by George Everest ; but its combination with Baker's fdbk., and internal evidence, makes it more probable that it is by the latter.

The first route from Solo...was taken privately, in the common manner, with a perambulator & compass, taking objects such as trees, villages, Hills, &c., in the direction of the route. ... The wheel was a large 5 foot one made & graduated on a gunbarrel at Solo; perhaps not very correct, but sufficiently so for purposes *merely topographical.*

In all the subsequent routes, however, I had a very good small double-armed perambulator, made by Berge [224]; and finding my former loose mode of taking the bearings of the road & objects liable to much error, I adopted another more exact, which...left no further difference than the variation of the compass, which, as I had not the requisite tables, I cd. not ascertain.

I had a large Ship compass fitted with sights, like an Azimuth [I, 200], & got 5 or 6 long bamboos with flags, & people to carry them on in front under charge of an assistant, who placed these flags in succession on angles of the road. ... All the mountains have many cross bearings. ...

The theodolite was used when practicable at the end of each day's work, to take the bearings of the large peaks of mountains, volcanoes, &c., but the dry season in Java is in General so hazy and thick that I had no opportunity of so doing. ...

A great proof of the correctness of this mode, and of the trifling variation the compass has in Java, is to be found in the fact that of the two surveys, ... one of 91 miles, and the other of 246 miles along the S. coast, ... when protracted off correctly from the Book without any allowance of variation, meet within 5 miles, or minutes; and the like trifling difference is to be found in all the subsequent routes. ...

I had always with me Sheets of paper, ruled off in parallels of an inch, which I filled up as I went on from station to station, on a scale of 2 inches to a mile, with a topographical eye-sketch of the Country. ... This, added to the field book itself, presents...every object visible from the roads traversed, & had completed my topographical sketches with far more accuracy & regularity than was prescribed by my instructions from the Java Government.

TRAVERSE TABLES

The traverse tables issued to the assistant surveyors in Madras were "Ewing's Synopsis or Robertson's Navigation, which contains every useful problem in surveying", and in some cases tables by Mackay[1].

In 1813 William Garrard of the Madras Engineers submitted to Government a trigonometrical Table which I have prepared with a view to the improvement of all surveys executed with the Perambulator and Compass. The plan was first suggested to me by Lieutenant Colonel Mackenzie, the Surveyor General, and it only differs from the Nautical Table used in Traverse sailing in being reduced to miles, furlongs, and yards, so as to accord with the index of the Perambulator; the object is illustrated by a separate detail of the bearings and distances of a march, and the mode of working them with reference to the Table, and it will, I trust, fully appear...that this system obtains, both for accuracy and despatch, a most decided superiority over the usual custom of laying down a route with the Protractor[2].

The tables were warmly approved both by the Chief Engineer and the Surveyor General, and Government ordered that, after being checked in the Surveyor General's office, one hundred copies should be printed for the use of military surveyors[3]. Boileau writes of them when surveying round Agra in 1828;

Captain Garrard's Madras Tables are very portable, and very correct in general, but they only extend to the nearest degree. ... I have generally looked out the Miles & Furlongs in Capt. Garrard's Book, & have taken the Yards from a small work called the "Practical Navigation"[4].

FIELDBOOKS & JOURNALS

After Colebrooke became Surveyor General in 1794, very strict rules were introduced that no surveyor should draw his allowances until his fieldbooks had been passed by the Surveyor General [I, 197], and many excellent surveyors were put to great inconvenience through the delays thus caused [I, 400]. Thomas Wood could not draw the allowances he had earned in 1800 until 1807, because

[1] DDn. 133 (302), 17–1–07. [2] MMC. 13–12–13. [3] Printed copies available, DDn. 156 (83), 5–10–16. [4] Journal, 4–7–28; MRIO. M 348.

he had claimed field rates during months that were officially specified as recess months [219].

The rules were, however, necessary to prevent abuse, and every Surveyor General applied them with the utmost rigour, for this scrutiny was the only form of control he could exercise over the quality of the work. Many applications for surveyors' allowances were turned down because work could not pass the test.

The standing rule was that a copy of the fieldbook should be submitted every month, whilst the original was submitted later with the protraction. The original protractions and fieldbooks were then forwarded in an annual batch to the Directors, who considered that "without an explanation of the mode in which a survey has been constructed, ... no reliance whatever can be had on its accuracy"[1].

Though surveyors were not permitted to keep any copy of fieldbooks or sketches after survey was completed[2], Government did not agree to Garstin's suggestion that they should only draw allowances after receipt of their *original* fieldbooks. They ruled that the original must be held by the surveyor till the advanced copy was acknowledged, otherwise "the entire loss of the Survey might be hazarded"[3] [289].

The rules led to endless correspondence, and special instructions had to be sent to every new surveyor, such as ;

You should send me a monthly report of your progress, and a copy of your fieldbook for each month, which you can transmit as opportunities offer. For this purpose I would advise you to copy off each day's work fair on coming to your ground, but...leave out the sketches. ... Your original fieldbook, protractions, and every other document belonging to the survey, must afterwards be sent to this office. ... Nothing which is inserted in the original journal...can with propriety be omitted in the fair copies[4].

Tod was bold enough to challenge the Surveyor General's criticisms ;

I never think of putting dates in my Field Book, not seeing the necessity of doing so; the names of places of departure and encampment I would have furnished had they been of the smallest consequence towards general information, but as it frequently occurred that I encamped at a Hamlet of five or six Huts, and often in the midst of a waste, ... the knowledge of them could not prove of any consequence. ... All places of consequence are noted in my Field Book, and distinguished by large characters in my maps[5].

We have not found Garstin's reply to this, but he was most indignant with Tickell, who was many months late in submitting his papers and maps for the survey of Elphinstone's march to Peshāwar [65–6, 310].

After a very long delay I have received the Field Book of your survey to Peshawar, and compared it with the protractions which ought, in the first instance, to have been forwarded to the Surveyor General's Office, but which were sent to me by the Military Secretary. ... All the...complaints have arisen from one cause, viz., the want of regularity in transmitting your Field Books. ... They might have been dispatched almost every month, instead of being upwards of twelve months in arrear. ...

The protractions of your survey sent to me are only carried on to Derra Ishmahel Khan, not much more than half the track surveyed, and none have been received of your returning route ; and...in your Field Book no observations for Latitude are inserted.

Indisposition may have retarded...the necessary documents ; however, it should not have done so unless it prevented your surveying the Route altogether, for the Books ought never to be on any account a single day in arrear. In the many months your journey occupied, only a few spare minutes could be found to report progress to this office. ...

Lieutenant Macartney, who has received one hundred rupees per month for his labour[6], regularly forwarded his Field Books, in which the latitude and longitude of the principal places are inserted, together with the protraction of his work. The unerring test of truth will shew which survey is more worthy of credit. Judging from appearances, ... being quite unacquainted with that officer, there was so much reason to be satisfied with his attention to his business that I recommended his being employed on full allowances[7].

Even five months later the wretched fieldbooks had not arrived, and Garstin wrote once more ;

[1] CD to B. 3–6–14 (14). [2] *BM Regs.* Ch. 65 (16–23). [3] BMC. 2–1–10 (84). [4] SG. to Smyth; DDn. 67 (141, 182) ; Oct. 1802 ; 9–3–03. [5] DDn. 82 (120), 4–4–09. [6] Compared with Rs. 618 drawn by Tickell. [7] DDn. 61 (184), 28–12–09.

It is with much concern I find myself obliged to repeat my orders, and to call your attention to my letter of the 28th of December last.

Without any further excuse or delay, I desire you will furnish this office with a correct drawing of your Route to Peshawar and back to Delhi. It is now a long time since you have neglected this very important part of your duty, even after repeated applications, both public and private, and, however painfully, I am compelled to say that if I am not very soon furnished with the document required, I shall be obliged to report to the Military Auditor General that it has not been furnished, and to cause stoppages to be made of all the allowances you drew as a surveyor...and also to report your conduct to Government, as I do not choose to incur censure for permitting any of the officers under my command to receive the public money, and do nothing for it[1].

Presumably Tickell had good reasons for the delay ; he appears to have left all survey to Macartney after Dera Ismail Khān, so had no fieldbooks or maps to produce. He was employed again as surveyor later on, and eventually had a distinguished military career.

The three months recess was a frequent subject of dispute as seasons vary so enormously in different parts of the country ; but it was a rule which the Auditor General interpreted to the letter. Garstin had the period postponed by a fortnight, but no hard and fast dates could be fair to all surveyors ;

Much inconvenience is found in the time assigned to surveyors to complete their Field Books, viz., from the 15th of June to the 15th of September. At the commencement of the rains, indeed during the whole of June, the country is seldom so flooded as to obstruct a surveyor in his duty, and until the end of September the waters have not sufficiently subsided to enable him to recommence it with effect. I...propose...to change the dates, and to have it ordered that surveyors are to be called in on the 1st of July, and to return to their duty on the 1st of October ; ... this term...to be allowed...to protract their works[2].

Garstin was the last man to be lax in administering rules, and he writes severely to White ;

I am prohibited from signing Bills unless the Field Books have been certified, and indeed my name to any not ordered by Government would be sufficient to oblige the Military Auditor General to reject them. The Pay Master disbursing cash on such authority would certainly lose...his office. Do look at the Pay Regulations, and you will find what I say to be strictly correct. ...

You cannot think I ought to certify that your Field Books were received in the office, when the Governor General and every member in Council must know you was in Calcutta. I would not do it for my own son. What sort of dependance could Government have on a public officer, once convicted of giving an untrue certificate ? It would be as weak and foolish as criminal, ... but would certainly cause the Bill supported by a false certificate to be rejected, probably procure me a very severe reprimand, and very possibly degrading dismission from all office, without assisting you[3].

As we have already noticed, Crawford was far from satisfied with Blake's fieldbooks [35] ;

All original Field Books are sent to the Court of Directors, where they are rigidly examined by their surveyor at home[4] ; what then will they say to yours ? ... I must do you the justice to suppose that your Field Book contains every degree of requisite knowledge, and that you only give me a loose extract—but still this will not alter the number of miles or angles [201]—when you recollect that the reasons for sending in the Field Books are ;

1st. To be sent home. 2nd. That in the event of the map being lost in transmission the work could be recovered by protracting in the Field Book.

Now...that no surveyor is allowed to retain any paper whatever [I, 262 ; II, 289] how would it be possible to lay off your map from the field books you have sent down ?

Whilst at the head of the office, it is my indispensable duty to see that every officer under me does his duty, ... and how am I to answer the Court of Directors, if called upon to know how I overlooked such slack work ?

I have heard, but I do not allow myself for a moment to believe it, that you work very hard all the cold weather, and bring up your work coolly behind the tatty[5] in the hot, dividing it into day's work to make it fill up to the rains. This report I spurn, as no surveyor could,

[1] DDn. 126 (29), 31-5-10. [2] ib. (106), 2-10-11. [3] ib. (152-4), 2-6-12. [4] presumably Horsburgh, appd. 1810. [5] Grass screen, kept damp to cool the passing air.

I think, possibly adopt it ; ... I defy him to lay down in May or June what he surveyed in October or November, at least not in the manner I should wish to have work done.

I do not wish to be harsh or severe, or by any means whatever to give unnecessary trouble, or to demand more of a surveyor than fair working ; I do not even stick up to the General Orders, for hitherto I have only asked for one map and one copy of the Field Book, whilst by the General Orders you ought to give in two of each, as per the following extract;

'All surveyors are to transmit their plans and Field Books in duplicate to the office of the Surveyor General, for the purpose of being regularly forwarded to the Honourable Court of Directors. Minutes of Council dated 6th April 1795' [I, 196–7].

I have long been looking out for some specimen of your work, but, long as you have been on the survey, not a scrap has as yet made its appearance. I am the more desirous of getting down even if it were but a portion of your map, that, by...laying it off from your Field Books, I may...report upon your abilities as a surveyor...which I am obliged to do twice a year. Hitherto I have been obliged to report, ... "not having as yet had any specimen of Lieutenant B. Blake's works, I cannot give any opinion". ...

You will without delay forward to me as much as you have done of your survey, whether it suits or not, and the duplicate you can send me at your leisure. With the map, or rather with your first Field Book, ... send me down all your celestial observations, whether for Latitudes, azimuths, or amplitudes, and the...calculation of each. In the event of any unnecessary delay...I must then report from your Field Books, and you must be well aware I have no favourable opinion of them [35, 201][1]. ...

Blake was not the only offender, and Crawford wrote to Robert Smith [47];

From every surveyor, I have hitherto almost regularly received their Field Books *monthly* ; how is it with you ?

You send me a meagre scrap from the commencement of your survey to the 15th June 1813 ; this field book was such...as forçed me to return it, although, ... I very *irregularly* passed a certificate ; ... however, as I convinced myself that the return of Dak would bring these documents into my hands, ... I remained quiet. ... Had I been called upon for these books, or been ordered to protract off in the office, ... what answer could I have given ?

In the next place you draw for...July, August, and September, at the rate of 250 Rupees per month. ... These three months allowances are...granted for...bringing up...arrears...in your Field Books or protractions of your map, and to keep up your Establishments. ... I never even till this moment received a single scrap, whilst I heard you were travelling all over the country to Benares and Lucknow. ...

Nothing ever can induce the Military Auditor General to pass a single Bill without my certificate of receipt and approval ; it has several times been tried, but tried in vain since I came into office[2].

These rules only applied to Bengal surveyors, and were unheard of in Madras or Bombay. Mackenzie writes of his Mysore survey ;

The Field Books were not called for, nor expected, till the end of the Season, or of the Purgunnah rather. But then I had a regular series of reports, Monthly & Quarterly, by which I saw & directed, as I do now in Travancore, the detailed Progress of the Survey, & at the conclusion a body of Memoirs were formed under distinct heads, accompanied by provincial Maps that appear to have given great satisfaction at home[3].

Though journals, or diaries, had not, of course, the same professional importance as the fieldbooks from which the surveys were protracted, their importance had always been stressed by Mackenzie.

As a journal, regularly recording remarks made on the spot, must be more valuable than speculative opinions formed at a distance, I would submit whether Diaries of this kind, ... directed to the proper objects, should not be kept by the Assistants on the branches of the survey ; to be communicated in the course, or at the end, of the journey or season. This is more particularly necessary to be observed where attention is directed to Natural History & to Statistical Enquiries[4].

[1] DDn. 131 (57, 106–7) 11–5–14 ; 14–10–14. [2] DDn. 131 (142), 24–4–15. [3] DDn. 156 (144), 30–11–18. [4] DDn. 41, 11–10–1800.

CHAPTER XVI

INSTRUMENTS

Supply of Instruments; Bengal — Madras — Drawing Material — Perambulators — Planetables — Sextants — Chronometers — Telescopes — Theodolites — Prismatic Compasses.

ALTHOUGH it was still the policy of the Company that surveyors should provide their own instruments, a few of the more common sort were held by the arsenals. The Surveyor General had a small stock of special instruments [192], and in 1802 proposed

that a few good...Chronometers, Sextants, and Theodolites, should be sent out, ... being so expensive in this Country as frequently to deter Gentlemen from purchasing them and learning their uses. These might be kept in store or deposited in this Office, to be delivered out occasionally as Surveys might be ordered[1].

The demand was so heavy during the Marāṭha war that in 1804 the Surveyor General could obtain neither perambulator nor compass. He writes later to recommend the purchase of a theodolite and protractor from an engineer officer transferred to civil[2], and adds that

there are remaining in this office two Theodolites by Ramsden, one of which has been rendered almost useless by an accident which happened to it many years ago; the other, tho' still serviceable, is from age and long service become less easy to adjust and observe with, ... & there is not a Mathematical Instrument Maker in Calcutta to repair them. ...

The theodolites, which have occasionally been sent out by the Hon'ble the Court of Directors, have been made by very inferior Instrument Makers, and have also been found, from their unwieldy size, to be less manageable and useful than the Instruments above mentioned[3].

The Directors took this complaint seriously [224];

Prior to the year 1797, the Theodolites sent to Bengal were only 7 inches in Diameter, which is the size used in H.M.'s Service. In the indent of your Military Board of 1797 it is expressly required that the Theodolites may be sent out 9 inches in diameter, which is a size no doubt much more unwieldy than the former. But in your indents of 1799 & 1800 Theodolites of the same diameter were required; and in 1804 the Circular Protractors were required to be made of the same diameter as the Theodolites, thus still approving of the 9 inches.

We are therefore not a little surprized that in June 1806 the Surveyor General should make a complaint that the Theodolites sent out are, from their unwieldy size, inconvenient and unmanageable. ... The Theodolites which have been ordered in the present season are of the last and most approved pattern of the late Mr. Ramsden; we therefore trust that the inconvenience complained of will in future be entirely removed[4].

In May 1806 the Surveyor General acknowledged a letter from White,

applying for a sextant and artificial Horizon, a theodolite, and chronometer, all of which instruments I am sorry to find you are unprovided with, as the difficulty of procuring them good of their kind, and of conveying them to so distant a part of the country, will be very great. I shall, however, use my best endeavours to procure for you a sextant and artificial Horizon, which. .are indispensably necessary for observing the latitudes, and if...a theodolite can be sent, with its stand, by Dawk Banghy[5]. I will send you a very good one by Ramsden belonging to this office, which I have for several years past used upon my surveys, and it is now as good as ever[6].

To Sackville he writes;

7th Aug. 1806. I cannot procure for you a Theodolite in all Calcutta, or any Instrument

[1] BPC. 26-8-02 (22). [2] Henry Wood, Ens. Ben. Engrs. 31-7-1800; tr. to BCS. 15-8-04. [3] BMC. 1-5-06 (42). [4] CD to B. 6-4-08 (96). [5] Parcels post by runner [47]. [6] DDn. 67 (464), 27-5-06.

better than a pocket compass. If you are in want of one of the latter...I can send you a very good one ; there is indeed an old Ramsden's Theodolite in the office, which I would send you, but it is not in very good order.

27th. ... I have dispatched to you by this day's Dawk Banghy, a case of instruments—1 Doz. Pencils—1 doz. Camel Hair Pencils—1 stick of fine Indian Ink—and a parallel Ruler—all of which will I hope reach you safe and without being damaged.

I was surprised to learn from Colonel Garstin that he had provided you with a very good Theodolite by Ramsden, which he has delivered to the care of Captain Wood of the Engineers, who is proceeding to Allahabad ; this being the case, the large Theodolite which I purchased for you...is superfluous, so...let me know what I shall do with it. If you wish it, I will sell it for you, and...will purchase a watch, or if possible, a Chronometer with the money, which being 350 S. Rs. ought to get a very tolerable one.

The little Theodolite I have delivered in charge to Captain Wood, who will either send it to you, or you can send a person to Allahabad[1].

In 1808 White asked for a new theodolite because his own, "which at first was a very indifferent one, became from a three years continual use totally unfit for further service", and the Surveyor General used his best endeavours to procure, ... at the expense of Government, the Instruments required ; the Military Board would not grant the Theodolite or other articles they had in store, but as ...the Supreme Council have assented to my indenting on Europe for Chronometers and Telescopes, I trust they will permit me to purchase those instruments for you. I have already sent off the Chronometer, and by the Dawk Bangey of Tuesday next I shall dispatch the only telescope on sale in Calcutta. ... If the Board consent to pay for them, I will lay out your money in the purchase of a Theodolite, etc., and send them up directly[2].

After White's camp had been looted by Sikhs [64], Garstin came to his rescue ;

I have by this day's Dawk Bangy dispatched a case of Mathematical Instruments and a good sextant, directed to you at Delhi, supposing them likely to meet you there. I have also procured an artificial horizon ; the Box being out of order, it has been sent to be repaired, & shall be forwarded when ready. The Chronometer that has been lost is wrote off to profit and loss of the Company, and you have had credit given for its having been expended on service[3].

In making special request that surveyors should be allowed astronomical instruments at Government charge [192], Garstin remarked that a good silver Chronometer may be generally procured for Eight hundred Rupees, and a portable telescope for observing Jupiter's satellites for about two hundred and fifty. If supplied with these instruments and a quadrant, every facility they require will be afforded. ... The Instruments will remain the property of the Hon'ble Company, and four or five sets will probably be as many as the service will demand[4].

An order was thereupon issued approving that survey officers should be provided with public instruments for observing latitudes and longitudes[5].

Other orders were ;

It appearing that the issue of perambulators and compasses for surveying roads has taken place to an extent far beyond the object of the G.O. of Government of January 1st 1804 [123, 197], ... for...Corps proceeding by roads so often marched by troops, and of course so perfectly well known that a re-survey of them can add nothing to geographical knowledge; the Commander-in-Chief is therefore pleased to restrict future applications...to such...as may proceed by routes which are imperfectly known [197][6].

When surveying instruments are issued from the Arsenal of Fort William, or any of the subordinate magazines, ... the instruments shall be delivered...to the officer or his Agent, and paid for on delivery, and...after such delivery no allowance shall be made on account of defect or injury, it being entirely at the option of the parties to receive them or decline them[7].

Officers in charge of Magazines are on no account to allow Mathematical instruments, or others of nice construction, ... to be put in the hands of a Siclegur[8], or any other person wholly unacquainted with their nature and use, for the purpose of their being disjointed, put in order, and polished ; but merely to have them well oiled and wiped ; to be repeated as occasion may require, and never allowing even a screw of them to be turned, except by a person able from experience to clean them thoroughly and properly[9].

[1] DDn. 79 (C, D). [2] DDn. 81 (63), 3-2-09. [3] DDn. 126 (30), 31-5-10. [4] DDn. 81 (57) 9-1-09. [5] BMC. 16-1-09. [6] BGO. 13-11-08. [7] ib. 16-10-10 [8] tinsmith or knifegrinder (I, 290 n.6). [9] *Carroll's Code*, XIII, Mil. Bd. 24, 24-4-10.

The package of Gunter's Scales, Gunner's Quadrants, and Instruments of that nature in wax cloth, is very exceptionable; they ought to be carefully packed in boxes, not jumbled with fife-cases, files, rasps, and such articles[1].

A careful account was kept of all Government instruments issued;

These instruments are placed to the debit of the officers for whose use they are intended, to the end that they may be fully accounted for, and not converted into private property. If spoilt by accident, or lost on actual service, credit is given, as was done to Lieutenant White, whose watch was taken by the Sheiks [64, 364][2].

William Morrieson was disgusted to find that he had to pay for instruments supplied from the Fort William arsenal, whereas the Madras officers he had just met [50], had their's "so liberally furnished by the Madras Government".

I have information from the Secretary to the Military Board that my instruments have been despatched, and enclosing me a large bill. I thought as the Company did not give instruments, they at any rate sent them for the public service to be returned when not wanted. I shall feel this doubly, as it is but a few months ago I sent home money for the purchase of every instrument I thought I should in future require. ...

Put in a good word for me with the Auditor General, as I have not yet got one Bill past, and Major Rose[3] has begun to stop a Hundred Rupees monthly for my Instruments before I have seen them, which leaves me a nett monthly allowance of 88 Rupees to defray all my expences, a thing evidently impossible, particularly as the hot winds are setting in with violence[4].

This must have been the more galling when he found that the perambulators fell to pieces almost at once [228].

On a later occasion the younger Garstin had his instruments stolen;

When I got my present appointment [41, 312], I was given to understand that...I should submit myself with instruments [*sic*], which I accordingly did at very considerable expence; also that before I left Dinapore, I applied...for a guard to protect the Instruments with me, but was informed I could not have one. ... A Theodolite and Sextant by Troughton were stolen in the Cantonments of Ghazeepore, and I used every possible exertion for their recovery, offering a pecuniary reward, ... but all my efforts have been ineffectual.

Government ordered replacement, writing that the

theodolite and sextant...were Stolen from him on his way to join Captain Hodgson, to whom he is attached as Assistant Surveyor; The Theodolite having cost in England 40 guineas, and the Sextant about 53 £. ...

His Excellency in Council, instead of authorizing Ensign Garstin to be reimbursed from the Public Funds, ... has determined that he shall be furnished from the Public Stores with a Theodolite and Sextant in some consideration of the loss which he has sustained[5].

Hodgson had sent home a large order for instruments on his own account, and heard that,

that a valuable collection of mathematical instruments, consisting of an equatorial theodolite, sextant, spirit levels, chains, and other apparatus for surveying, with a collection of books on the subject, have been sent to me by the Wynelton [?], which I fear is taken by the enemy, but if not, and I am so fortunate as to receive them, I shall be better able to send perfect plans. The instruments were made and selected for me by Troughton[6] who is now considered the best maker. I will desire him also to send me a Telescope[7].

The instruments arrived safely, and three years later he expected

an excellent Chronometer of the value of 1000 Rs. ... for the Longitudes, & have also sent for a Circular Instrument to Troughton, & have now Instruments coming up the River from England[8].

Fleming writes to the Surveyor General from Murshidābād [18];

I have hitherto been using a common *Ivory* Protractor; Will you...have your Eye about, & if you lay your hands on a good Circular one with a Nonius, and buy it for me, I will be very thankful to you. Pray also...find out if there is anyone in Town that knows anything of making, or repairing, or correcting Mathematical Instruments. I should like, if I travel in, to send my Theodolite to his Workshop[9].

There was more than one opinion on the policy of supplying Government

[1] *BM. Regs.* I. vi (197), 7–8–10, Mil. Bd. [2] DDn. 126 (31), 1–6–10. [3] Hugh Rose (d. 1836). Ben. Inf. (1785–1816); Dep. Pymr., Cawnpore, 1805–13. [4] DDn. 82 (135, 146), 17–1–10; 14–3–10; [5] BMC. 12–12–15 (137–8). [6] Edward Troughton (1753–1835); FRS.; *DNB.* [7] DDn. 82 (75), 4–1–10. [8] DDn. 130 (97), 14–11–13. [9] ib. (69), 11–9–13.

instruments, and many surveyors greatly preferred to purchase their own. Colebrooke writes in 1807 ;

Having found after repeated trials...that the mathematical instruments which are usually sent out by the Hon'ble Company are of a very inferior kind [221], ... I...suggest that the Hon'ble Court of Directors might be requested not to send out any more instruments, with the exception of a few good perambulators, but that officers...should be allowed to... purchase their own, ... for which contingent bills, signed upon honour, and countersigned... by the Surveyor General, might be passed. ... Government could be no losers, as...the Company's Instruments...are...rated very high, and the prices charged might be sufficient to purchase the very best instruments from the first...Makers in England[1].

This suggestion was not accepted, and further complaints reached the Directors, who explained that

Mathematical Instruments...have been left to the maker and pass no Survey, except as to Number and Prices. It was considered the best plan to throw the whole responsibility as to quality on the manufacturer, and to dismiss him if his Instruments proved defective. Those against whom the complaints from Bengal were made have been dismissed, and with the change in the men, we trust there has been a change in the instruments[2].

In submitting the home indent of 1814 Garstin, as President of the Military Board, noted that

Almost all the Instruments sent out are of a very inferior quality, and are charged at a very high rate. A Theodolite exhibited at the Board on the 11th October [1814], and Invoiced at upwards of Fifty Pounds, was not worth above Twelve, and was such an instrument as no reputable Maker would exhibit in his Shop. The drawing Instruments are wretchedly bad, the Steel points not tempered, and, in short, throughout the whole of this Department the Goods sent out are very dear and very indifferent. Double wheel Perambulators do not answer[3].

The Directors replied that

Mathematical Instruments are forwarded to India on the credit and responsibility of the Maker alone, as we found that an Establishment for their Survey upon Scientific principles would lead to a considerable expense, & perhaps after all prove insufficient.

That our Armies might be furnished with the best Instruments, we have employed... Mr. Berge, the successor of Mr. Ramsden, who not only furnished all the Superior descriptions of Instruments for H.M's. Forces, but has Established a high reputation in the line of his Profession. The very vague way in which the complaint from Bengal...is made...leaves it impossible for us to say whether the Instruments...are Mr. Berge's instruments, or his Predecessors, and whether they may not have been in store these twenty years[4].

Berge was scornful;

It is with great surprise I see...a most serious complaint. ... I know of no neglect or bad Instruments sent to India, and I believe them to be as perfect as any that are made in England, and the price is not more than I charge the Ordnance Department. ...

This Theodolite was delivered from me to be shipped for Bengal on 12th November 1808, so I conclude it was about five years and a half in India before it was determined to be imperfect ; I most certainly desire this Theodolite to be returned, and that it may be examined by some respectable gentlemen conversant in such Instruments, and I have no doubt of their determining that the Person or Persons who formed the Report had not the ability of Judging a good from a bad Theodolite.

As for the Instrument not being worth more than Twelve pounds, if it is such as there represented, it is of no value, but useless, and should have been returned Five years before this time ; and as for overcharge in price, under the present circumstances of the time, although charged £ 40 formerly, this construction of Theodolite would not be reduced more than 5%.

The drawing instruments cannot be in the wretched state as there represented, as they are made by the best workmen, and I generally correct the Points and Pens myself, knowing the attention that is necessary to perfect them, nor can such Instruments be charged at a less price.

Perambulators I have made and sent to India for the Hon. Company near one Hundred, but never sent one with a Double Wheel, knowing that was a bad principle[5].

By the time this letter reached India, Garstin had sailed to Europe on furlough, and the Military Board weakly dissociated themselves from his complaints[6].

[1] DDn. 81 (97), 14–11–07. [2] CD to Bo., 18–12–11 (19). [3] Bengal Indent 1–11–14. [4] CD to B. 15–3–16, (12–4). [5] ib. ; Note by M. Berge, Piccadilly, 10–7–15. [6] BMC. 4–10–16 (50).

SUPPLY OF INSTRUMENTS, MADRAS

In Madras most surveyors provided their own instruments, and Warren writes ;

In 1802 I was transferred from Captain Mackenzie's to Major Lambton's survey [101, 237]. Here again the only instrument I received was the large circular instrument now with that Officer[253]. The rest which I used were my own property, nor did I ever think of troubling Government on the subject, except when a very valuable case of Instruments was stolen from me near Salem—the thief was apprehended and convicted at the Court of Circuit—but this I did without success, Government having decided that such an application was inadmissable.

I had a 3 feet Telescope ordered from England, a new sextant, and two large cases of silver Instruments[1].

Mackenzie collected a number of instruments of all kinds, some of them his private property, but many either issued from Government stores, or purchased from other officers on Government account. On the whole a much larger stock was held than in Bengal, owing to the wider employment of junior military officers and assistant surveyors who were not in a position to purchase their own. Mackenzie writes of the Mysore survey in its early stages ;

The expence of providing instruments for this work...has been from the commencement comparatively very trifling, as the surveyors had actually provided themselves at their own private charge with most of what was requisite[2].

The arsenals helped with repairs ;

As I have occasion sometimes to apply for small repairs of instruments & the assistance of Artificers, which can only be obtained at the principal military stations, and these being so seldom required that I conceive it unnecessary to incur the expence of attaching artificers to this survey, I...request that the necessary...authority be given to the Commissaries of Stores at Seringapatam & other stations above the Ghaats, to afford me...occasional assistance from their Public Stores, and of artificers for repairs[3].

At the Military Institution, a special grant was provided for the purchase of a planetable for each officer as his private property, and in 1806 it was resolved

that all instruments...shall in future be provided at the public expense under the Superintendence of the Quarter Master General of the army[4], to whom all officers employed on surveys will address their indents[5].

The Quartermaster General found,

a considerable degree of difficulty...in obtaining instruments of a proper description at Madras, but...it will not be found necessary to purchase any more in this country, as some...have been sent on the last ships from Europe, in compliance with an Indent from the late Quarter Master General. ... Theodolites, the instruments most necessary...have not arrived in the last ships[6].

He asked sanction to purchase instruments for astronomical observations on the Travancore Survey ;

They are of good quality ; their prices are moderate. ... I have also included in the list a reflecting telescope of very superior powers, which has been offered for sale at its original price ; and as it would be exceedingly useful in celestial observations, it may be desirable to secure it for the public service[7].

Damage to private instruments meant loss and delay, and in Travancore [131] Blair reports that he

was stopped by a screw of my Theodolite breaking. This instrument being my private property, and the Resident...having informed me, upon a former application, of the great disinclination of Government to replace anything...broken on the public service, the survey must necessarily be at a stand till I be supplyed with another Theodolite[8].

He had no difficulty, however, in selling his instruments to Government when he left the country, as also De Havilland, who,

in purchasing these, incurred a great expence, as...the Regulations of the services did not provide for officers...being supplied with Instruments as they do at present. ... If they should answer the purpose of your Department, or of the Military Institution, I should

[1] MMC. 21–6–11. [2] DDn. 41. 1802. [3] MPC. 29–4–05. [4] At this time responsible for all Madras surveys [300–2]. [5] MMC. 5–12–06. [6] ib., 13–2–07. [7] ib. 24–11–07. [8] ib., 4–11–06.

be glad that His Excellency were pleased to order their being received at the prices they have cost me. ...

An Astronomical Quadrant	...	... Pagodas	150
A Reflecting Telescope, for observing the Satellites of Jupiter		... ,,	150
A Theodolite, complete	...	... ,,	140
A Circular Reflector, graduated to 20″	...	... ,,	70
A Spirit Level and Stand	...	... ,,	30
A most Excellent Timekeeper by Earnshaw	...	... ,,	228–25–00
A small Telescope & Stand	...	... ,,	30
A case of Instruments & Astrolabe	...	... ,,	50
A Colour Box	...	... ,,	18
A Brass 4-ft. Ruler	...	... ,,	8
	Total	... Pagodas	874–25–00

N.B. I lost two Time Keepers, one after the other, when they were going to be cleaned, or coming up to me in Camp. This was a serious loss of no less than 400 pagodas, they having cost me 160 £ sterling.

The purchase was sanctioned on the Quartermaster General's report that the Depot of Instruments has been so much drained by issues, as to have made it impossible to comply entirely with an indent recently presented by the Engineer's Department proceeding on Foreign service[1], and altho' the Instruments presented by Mr. De Havilland are not so Good as when new...they are worth in India the price charged[2].

On the appointment of a Surveyor General, he was made responsible for the distribution of instruments [298–9][3], and all surveyors, including Lambton and those employed under the Quartermaster General, had to submit quarterly returns to him.

The assistant surveyors sent out from the Surveying School [139] were not always provided with the best instruments, and Warren forwards an indent from the Collector of Tinnevelly, with a letter from the surveyor himself, which explains the reason of his indenting for a *Theodolite*, that which was in the charge of Read being, by his account, totally unfit for service [142]. The Board are no doubt aware that there is no surveying without such Instrument, and therefore the services of J. Robinson and T. Hill will be lost to the public if the Collector's application be not attended to.

I likewise subjoin an indent for Instruments from the Collector of Madras. ... I have been informed...that their surveyors have never had any assistance of the kind ; I am therefore at a loss to imagine what they have surveyed with during three years that they have been attached to that Cutcherry. ...

I shall take an opportunity of mentioning the general prices of the surveying Instruments. ...

For a first sort Theodolite, by an approved maker, if entirely new	.. Pagodas ..	120	
For a second-hand do.	.. ..	100	
For second-sort Theodolite	.. ..	80	
For a second-hand do.	.. ..	60	
A Sextant, new	.. .. ..	60	
A Sextant, second-hand		ps.	30 or 40
A Circumferentor, new		..	25 or 30
,, second-hand		..	15 or 20
A plane-table, without a compass or side Telescope	..	..	20
Pocket case of Instruments, first sort		..	16
do. second sort		..	7

These Instruments (high as their price may seem) are so very scarce in India, that *even at that rate* they are hardly to be procured at present ; there are none belonging to the Public at the surveying school, and the boys are surveying with my own Instruments[4].

He writes later ;

The Superintendent of Tank Repairs complains...that his Sub-Assistants serving in the Nellore District [149–50] have no Theodolites to carry on their Triangles with, and that the sextant which he had from the Observatory several months ago (the only one which could be spared...) proves unserviceable.

These disappointments are the unavoidable consequence of the system which has ever obtained at this Institution, which prevents the Inspector of Revenue Surveys to keep up a sufficient stock of Instruments ready at hand, unless it be at his own risks and expense[5]. ...

Pressing as Captain Caldwell's want of Instruments may be, I do not know where to

[1] The expedition to Mauritius [I (321); II, 320]. [2] MMC. 4–5–10. [3] MGO. 9–4–11. [4] M Rev Bd., 12–3–07. [5] Note Warren's trouble with English idiom.

find one of those which he requires, excepting a sextant, which I suppose might be procured second-hand from the sea-faring Gentlemen who frequent this port. Should, however, your Board...authorise the supply required by Captain Caldwell, I shall use every endeavour to procure two Theodolites from Bengal, which is the only part of India where such Instruments are likely to be found[1].

DRAWING MATERIAL

Good drawing paper was often "very difficult to procure", and, writes Macartney from Delhi [68], "I was obliged to borrow that on which my former protractions were made, as that which I got up from Calcutta was not fit to be used"[2].

Fleming wrote down to the Surveyor General from Murshidābād [18];

Not being able, even with your kind asstce., to Procure the Proper kind of Paper for our Survey, and neither Schalch or I being expert at joining smaller sheets in a handsome manner, I feel...that you will assist me by suffering one of your people to join and send me up some. Our Plan is *only* 12 feet long and 6 feet broad, done on a scale of 9 inches to a mile[3].

to which Crawford replied; "I have not been able to get a Sheet of drawing paper for myself, and I don't think there is any tolerable to be had in Calcutta"[4]. He writes about the same time to Hodgson;

There are no complete magazines of drawing Instruments to be had, or I would send you one with pleasure, nor any drawing paper worth a sixpence; I am hard pushed for that article just now myself[5].

Reynolds had better fortune at Bombay, on one occasion at any rate, for he writes to "Edward Nash Esq.", presumably not in the Company's service;

Having accidently heard that you are in possession of a considerable quantity of large drawing paper, I...hope that, after keeping sufficient for your own immediate wants, you may be able to spare the remainder to the Hon'ble Company for the duties of my Office. ... May I beg the favour of you to state the quantity you may be able to spare, and the value you sett upon it, that I may obtain...permission for the purchase of it.

Nash replied that he could

spare you eight hundred and ninety sheets (890) thereof, for which the amount will be three hundred and eighty rupees (380)[6].

Water-colour paint was another item that caused anxiety, and in 1812 Troyer was hard put for

the requisites for drawing for the Military Institution, ... not to be got but by buying entire colour-boxes, of which at present scarce one more is procurable at Madras. The colour-boxes hitherto procured of different magnitudes contain a great number of articles entirely useless, and are scantily provided with those which are indispensable for Military Drawing. ... An investment of colours...and of brushes, procured direct from England, would save a great part of the expense which hitherto was unavoidable, and much better answer the intended purpose.

He asked for an annual supply of 50 cakes each of "Lake—Carmine—Gamboge—Prussian Blue—Prussian Green—Burnt terra de Sienna—Green Bice" and also "an assortment of Camel hair brushes, chiefly of the middling size, and some large ones, 50 dozens"[7].

PERAMBULATORS

We now turn to the various patterns of instruments in common use, and start with the perambulator, which was in in universal use [I, 198–9]. Pringle's pattern was still the favourite in his own presidency, and Goldingham writes in 1797;

The Surveyors at Dindigul [I, 146] inform me...that their measuring wheel, which was made in England, does not answer the purpose owing to the ruggedness of the Country.

[1] M Rev Bd. 6–8–07. [2] DDn. 82 (119), 7–2–10. [3] DDn. 136, 6–5–14. [4] DDn. 135 (40), 9–4–14. [5] ib. (41), 11–5–14. [6] Bo MC. 20–1–07. [7] MMC. 1–9–12.

Independant of the inaccuracy of these machines when on rough ground, they are both complex and liable to get out of order. I therefore wish...to have some measuring wheels made up for the Public Service on a construction invented by the late Major Pringle, which are in every respect preferable to the Common Wheels, and far less expensive[1].

In 1804 he was still making them up for the district surveyors.

The same contempt for European design was held in Bengal, the Surveyor General writing in 1807 that those "issued out from the Company's stores are so slight in their construction as sometimes to fall to pieces at the very commencement of a march" [197][2].

Morrieson writes from Bundelkhand in 1810 [50] of an error of two miles which he had found on closing a circuit;

Having examined my Perambulator very minutely, I find there is nearly a yard gained in the 100; which will of course give 2 miles over in the distance. ... The Perambulators I have received from the Arsenal are very ill-calculated for the Country, and it appears somewhat extraordinary that the most essential part (the Wheel) should be made upon such a bad Construction, and so very slight. Should we again return to the Gauts, I have little doubt of their being knocked to pieces in a very short time, which is a serious consideration to me when I recollect that each of them stands me in 192 Rupees[3].

Hodgson writes in 1813 [37];

April 23rd. Here I was detained a day to repair my Wheel, the axle of which had worked loose. I was obliged to send to a distant village for workmen. ... The Brass-framed Perambulators do not answer so well as the wooden-framed ones. Screws in the former are too small for the weight of the Instrument, get loose, & fall out [57].

30th. At Meerut I effectually repaired the Wheel, & purchased an additional very good one, & a chain for examining the wheels; no surveyor ought to have less than 2 or 3 wheels and 2 chains of 100 feet in length[4].

Crawford writes to the Military Board when Surveyor General;

As a Perambulator originally costs in England from 7 to 10 Guineas, I do not think it would be worth while...sending them home and bringing them back again; and as all the inside work would require to be replaced it would cost almost as much as a new one.

As the Perambulators that are generally sent out by the Company are very slight and indifferent, and some of them even with new outsides and old works within, they soon of course get out of order in the mechanical part, and from their being by no means sufficiently strong in the outer works to resist the effect of this very trying climate, they soon fall to pieces. They ought therefore not only be warranted by the makers but be so constructed as to enable them to stand the effect of the hot winds, and to enable them to run over the gauts and rocky roads that so often occur in this country[5].

In 1814 William Brett, of the Madras Artillery[6], designed a new cyclometer for the large Madras perambulator;

Distances may be measured by means of it to a fraction of a foot, while the smallest division on the common perambulator...is equal to thirty feet. The improvement consists of a circular plate of brass, whose centre coincides with the centre of the wheel, and is graduated so as to give the feet corresponding with any part of each revolution. The index, which remains always in a perpendicular position, gives the odd feet and quarter feet in any measurement. I have fitted up a Perambulator...and find it to answer completely the purposes in view. The invention is ingenious and simple[7].

Orders were given that all perambulators "from the Gun carriage manufactory or the arsenal of Fort St. George" should in future embody Brett's graduated circle and index.

PLANETABLES

An early account of the "Plain Table" by Bion in 1723 describes it as having an outer wooden frame graduated in degrees, a circular compass, and a sight rule[8]. Puissant, in 1807, describes the *planchette* and its use, and resection from three or more known points by means of tracing paper [212][9].

[1] M Rev Bd. 6–7–97. [2] DDn. 81 (97), 14–11–07. [3] DDn. 82 (154), 8–4–10. [4] Fdbk., MRIO. M 347. [5] DDn. 131 (100), 25–8–14. [6] Wm. Thompson Brett, at Cannanore 1814; d. Vizagapatam 1857. [7] Note by Morison, acting SG., MMC. 6–5–15. [8] Bion. [9] Puissant, III (155).

The first record of its use in India is that of Read's rapid sketch of Salem District in 1793 [I, 193], and Troyer introduced it as the standard instrument at the Military Institution in 1805 [125, 214]. He arranged for "the best plain tables such as local circumstances could furnish", and asked that each officer should be

allowed the sum of thirty Pagodas for procuring his own plain table, which was the price paid for it last year to Ch. Chenaud[1]. The instrument being made under the particular inspection of each Gentleman will succeed so much the better, and...any further repairing of the instrument, if necessary, will fall to the account of each Gentleman[2].

The following year the start of field work was delayed by the failure of the instrument maker to deliver planetables in time [126]. Later, the books show "21 Plain Tables with their fiducial edges" besides "21 Brass Chains".

Though it has been said that the early Madras planetable was only 16 inches square[3], that used by the Military Institution must have been somewhat larger than 24 inches by 18, the area of each plotted section [215].

Garling was a strong advocate of the planetable for general use, and used it in Goa for all scales ;

I have supposed the Plain Table the most preferable instrument for use in the prosecution of the Survey ; but as I remember you suggested the Plain Table would be laid aside on reducing the scale, I have written a private and separate paper, in which I have attempted to give you my valuation of that instrument [215-6]. In estimating the value of instruments, the considerations are *accuracy* and *facility* ; ... the Plain Table is not inferior in accuracy, and of superior facility in use, to any other instrument. ...

The table being set by means of the compass needle, a sight of two of the protracted objects gives the station ; a sight of a third will prove it and, as the principle of this proof is mathematically just, the accuracy of a station on the Plain Table determined by three points admits of no question on a small scale. ...

The Plain Table facilitates Surveying in the particular of requiring no protraction of angles ; ... the sketches are mostly made at once on the Plain Table, ... which not only gives less trouble, but more accuracy also, because it is the original and therefore best sketch which makes the survey. The sketching itself is much facilitated by the readiness with which the bearings of the sinuosities or other detail of objects is taken, and by the evident connection of each part with the whole which is before the eye on the board. The sketches taken in going from one station to another are immediately put down, and therefore under the advantage of a perfect recollection of them.

The Plain Table is a very portable and durable instrument, subject to less casualties than any other[4].

On the withdrawal of the military officers [156] Garling paid fifty pagodas for two of their planetables.

It is interesting to note that though the planetable was so early introduced into India, becoming firmly established first in Madras and then in the Punjab, it was not taken up by the Ordnance Survey of Great Britain till late in the nineteenth century. According to Close it

might have been most profitably used between 1795 and 1825, a period during which there was only the one-inch map to think of. The ignorance which prevailed as to the value of the plane-table lasted to a much later date. For instance, the Palestine Survey, which was begun in 1871, was carried out, as regards the detail, by means of the prismatic compass, and this in a country which is exceptionally suited to the plane-table. ... The writer remembers that, as late as 1897, the field training of the topographical sections of the Ordnance Survey, which were intended for service abroad, was confined to the prismatic compass[5].

SEXTANTS

Sextants and reflecting circles remained popular for taking astronomical observations to a very late period, but special precautions were necessary for protecting the artificial horizon from wind and insects [I, 162], and from about April to September the midday sun was too high in the heavens for reflection [191-2].

[1] Possibly related to Chenaux, a pilot, whose widow d., Chandernagore, 1842, aged 80. [2] MMC. 4–11–06. [3] *Imp Gaz.* IV (491), which ascribes invention to Pretorius in 1537, and first pubd. description to Leonhard Zubler in 1625. [4] DDn. 127 (67–8), 3–9–11. [5] Close (38).

Among the instruments which Goldingham sold to Government when proceeding on furlough, were

a Reflecting Circle, silver inlaid, with stand, artificial horizon, quicksilver, & forming a complete apparatus for all astronomical observations usually taken with the sextant, this instrument being far preferable.

A Sextant, silver arch, with a stand, artificial Horizon, & the whole fitted in a square mahogany case, & also forming a complete apparatus[1].

In 1813 Crawford sent Raper [46–7]

a circular Reflecting Instrument. ... The reflecting circle by Troughton, ... cost me 200 second-hand, and I never used it. The false Horizon and apparatus cost Rs. 60. ... You will find a set of instructions by the maker. From having three microscopes, and also being circular, they are more to be depended upon than a sextant, and not so easily deranged[2].

Before leaving India Blakiston sold to Government "a Reflecting Circle, price 100 Pagodas. ... It is graduated in Silver ; is in perfect order, and the value placed on it moderate"[3].

Franklin writes that his "Sextant is very passable, of about 9-inch radius, and is so well finished that the utmost error like to obtain by measuring the diamr. of the Sun is 37″ subtractive; the vernier gives to 7½″"[4].

Sextants had to be tested from time to time for index error.

CHRONOMETERS

Chronometers were still very delicate and troublesome, and most expensive [I, 202–3]. Mackenzie writes to Warren from Bangalore in 1800 ;

Your Time Piece has unfortunately stopped on the day after I came away from Colar ; on coming to the ground as usual, I took it out to wind it & found it in this state ; giving it a shake horizontally it was set going again, but, as we did not know the time that elapsed while it stopt, ... it will be necessary to set it to a new time. I cannot account for it unless it be owing to the Jolting of the Palanquin which I do not myself use, but recommended to the Bearers to be careful ; I have seen the same happen before [I, 203].

Mr. Arthur is bringing my time-piece back from Madras, but for want of Time sufficient for ascertaining its rate anew, Mr. Goldingham has directed him to take its rate at any place where he may be at a fortnight at a time, and the situation of the place may be ascertained at a future period. In your case I see no remedy but the same, and from Colar you can have it easier sent down. I think it would be possible to train a trusty *black man* to wind it daily, and to carry it with more safety back[5].

Silver chronometers were generally valued at Rs. 600. The gold one which the Surveyor General sent up to Tickell for his journey with the Elphinstone Mission [65], had been bought by Garstin from Colebrooke's estate for Rs. 1,200[6]. It was probably the same as that issued to Sackville, which

entirely disappointed the expectations we had formed of its correct rate of going, and, in spite of every precaution, it had stopped going altogether during my stay at Ganjam when, from the well-known Geographical Position of that place, I had entertained hopes of learning its exact Rate, and deriving Benefit from its use during my return through the Province. ...

I have since been called upon by the Military Board to deposit the Sum of Sicca Rs. 1,200 on the Grounds, no doubt, of its being in good order, but as this was not the case...I communicated to the Board the real state of the Watch and, unwilling to subject myself to an useless Expence so very considerable, I lost no time in returning the Time-keeper[7].

For observing Jupiter's satellites Franklin writes that he had

written to Lieut. Ralph, who edits the Hirkaru paper[8], to buy me a good chronometer or, if he can get an excellent stopwatch which shows and marks seconds, I prefer the latter. ... I have also written to England for a 3½ foot Achromatic Refracting Telescope of Dolland's construction. ... No expence shall be wanting to procure instruments of the best kind[9].

[1] MPC. 30–11–04. [2] DDn. 136 (22), 22–11–13. [3] MMC. 25–2–12. [4] DDn. 130 (105), Nov. 1813. [5] DDn. 41, 13–4–00. [6] DDn. 81 (107), 20–5–09. [7] DDn. 82 (201), 16–6–10. [8] James Ralph (1782–1857); Ben. Cav., Corn. 1800; Cashiered 1808, "for disorderly & mutinous conduct on parade in front of the regt., ... and for endeavouring to incite the men...to mutiny". ed. *The Mirror*, Calcutta, *c.* 1808; *Bengal Hurkuru*, *c.* 1813; Ens. HM 59th Foot, 1813. Hodson III (597); MI. Aurandābād, Crofton, II (107). [9] DDn. 130 (105), 29–11–13.

On return from furlough in 1814, Webb brought out several chronometers and was allowed time at Calcutta to overhaul them ; "The Chronometers have been kept regulated to mean time to facilitate their use on Shipboard, but...they ought now to be re-adjusted to Sidereal Time"[1].

In 1814 Crawford obtained sanction to purchase for the Surveyor General's office, "an Astronomical Clock ; ... one has been offered at Rs. 2,000 ; it cost in England 220 Guineas"[2].

TELESCOPES

These were required for observations of Jupiter's satellites, and Dollond's make was usually favoured. In 1813 Crawford wrote to Smith, who had relieved him in Mirzāpur [47] ;

The Chronometer was sent by the regular boats to the care of your brother at Dinapore, and I hope will reach you safe. The small telescope that my brother[3] brought for me some years ago expressly for the purpose of observing the satellites of Jupiter, and for which he paid ready cash 10 guineas, you may have if you like, paying me whatever you may think it worth ; the magnifying for terrestial objects is near 50 times, and for celestial observations 80 times[4].

THEODOLITES

Theodolites of this period varied enormously in design, and were by various makers. We have already noticed the poor quality of most of those that were sent out officially [221, 224] ; the better patterns came on special order, and those obtained by Lambton and Garling have been described elsewhere [255]. Mackenzie writes in 1804 ;

The instruments I have commissioned from Mr. Carey[5] have lately arrived, and are much to my liking ; a theodolite, in particular, with all the late improvements of rackwork, telescopes of different kinds, and the graduated circle done in silver, which is much superior to the brass work which tarnishes when exposed to the air. I am completely set up with this and a smaller instrument, and several other instruments. My brother[6] writes me, if he had not attended closely, he believes they could not be got so soon, as Mr. Carey is much pressed by the demands upon him.

Mather's theodolite

was one of Adam's, with the late improvements, but with only one Telescope, shewing the objects inverted. The diameter of the graduated arch 8 inches, on which the degrees were divided into halves, and they again sub-divided by a vernier into minutes.

In the angles for determining stations, the nearest minute is taken, but in those for villages only the nearest duo-decimal part, or 5 minutes, because they could not be laid on the Map to greater exactness by the 8-inch protractor, ... the degrees of which were also divided into halves, but without an Index or Vernier[7].

Mackenzie writes to Lantwar who was on survey with Hamilton [154] ;

As you think one of the theodolites is superior to the other, I wish you to arrange that the best should be alternately used by each while extending the primary stations ; after which the detailed work may be filled up by means of the other with little chance of error. These instruments are designed for the benefit of the service, and not for the convenience of anyone in particular[8].

Franklin was perfectly pleased with his theodolite, which

was made to order...and brought to this Country by Colonel Kyd ; I bought it of Captain Steele [18] ; it is graduated to ½ degrees, and the Vernier gives the minutes. The Telescope is admirable, and mounted on a half-circle of Altitude, graduated in the same manner. The Instrument is levelled by Screws and three spirit levels, and may be set to the greatest nicety[9].

In 1814 Crawford bought a theodolite,

[1] BMC. 9–12–14 (95). [2] ib. 4–6–14. (80). [3] Not identified ; was probably in England. [4] DDn. 135 (3), 9–7–13. [5] Wm. Cary (1759–1825) ; *DNB*. [6] Alexander Mackenzie, of Hastings [I, 349]. [7] DDn. 44 (15), 1802. [8] DDn. 83, 16–7–10. [9] DDn. 130 (105), 29–11–13.

just out from England, an Excellent Instrument, with chamfered and silvered edges, two achromatic glasses, with rackwork or every kind, & in addition...(in the same box) an excellent protractor with Glass Centre and folding arms ; and the whole came to Rs. 400[1].

An interesting account of *The Evolution of the Dividing Engine* and the work of the great instrument makers, Jesse Ramsden, John and Edward Troughton, will be found in *Empire Survey Review* of April 1944[2].

PRISMATIC COMPASS

The prismatic compass, in which a mirror attachment allows the graduations of the compass ring to be read in a mirror simultaneously with alignment on the object, was invented by Kater [313][3], and Hodgson writes in 1814 ;

I have just received from England a Pentagraph, &c., and two newly invented Surveying Compasses, which I think you would much approve of; so far as they read off, i.e., 20 minutes, they are superior to the ordinary Coarse theodolites, & will be expressly useful where great accuracy is not required, as in route surveys with an Army[4].

The following advertisement is taken from the *Calcutta Gazette* of 5th January 1815 ;

The New Invented Patent Azimuth & Surveying Compass, made & sold by Gilbert & Son. —There is a prismatic *Lense* of strong magnifying power contained in a Brass Box which, when in use, should be turned over the Card. ... When taking the Bearing...it is only necessary to place the eye close to the prismatic Lense in such a situation that the Pupil of the Eye may be exactly at the bottom of the slit over the sight hole, when the observer will at the same time see the contact of the opposite hair and the object viewed, and read off the point of the compass the degree on which it bears, with very great accuracy. ... It will be found nearly equal to the most Expensive Theodolite, and superior to any Azimuth Compass hitherto invented.

[1] DDn. 131 (105), 10–10–14. [2] *Emp Svy Rev.*, 52. VII (226–35). [3] South Kensington (60).
[4] To SG., DDn. 136, 29–3–14.

CHAPTER XVII

LAMBTON'S TRIGONOMETRICAL SURVEY[1]

The Plan — Mysore, 1800–2 — Coromandel Coast, 1802–3 — Across the Peninsula, 1803–6 — South Peninsula, 1807–10 — Extension Northwards, 1811–5.

EARLY in December 1799, whilst Mackenzie was making preparations for his topographical survey of Mysore [91–3], Lambton put forward his first proposal[2] for a trigonometrical survey to fix prominent points over the whole south peninsula [I, 9 ; II, 3] ;

Having long reflected on the great advantage to general Geography that would be derived from extending a survey across the Peninsula of India for...determining the positions of the principal geographical points ; and seeing that by the success of the British arms...country is acquired which not only opens a free communication with the Malabar Coast, but...affords a most admirable means of connecting that with the Coast of Coromandel by an uninterrupted series of triangles, and of continuing that series to an almost unlimited extent in every other direction ; I was induced to communicate my ideas to the Right Hon. the Governor in Council at Madras, who has since been pleased to appoint me to conduct that service. ...

It is scarcely necessary to say what the advantage will be of ascertaining the great geographical features...upon correct mathematical principles ; for then, after surveys of different districts have been made in the usual mode, they can be combined into one general Map[3].

Lambton was at this time a subaltern of the 33rd Regiment of Foot, holding the appointment of brigade major to King's Troops in the presidency of Fort St. George. From July to November he had been with the Grand Army as staff officer during its march through the north-western districts of Mysore[4], and it was on his return to Madras that he laid his scheme before Government. In a letter from Madras of December 6th, Mackenzie warmly supported the proposals [115–6], and Close replies from Bangalore that,

having examined the consideration which you have given Captain Lambton's proposition, I cannot but say that it appears to me to be extremely liberal, and that...the design...should be commenced by him without delay. ... He might commence...in the tract of territory under our authority and, as the results of his labours would be designed for general benefit, ... there would be no objection to his proceeding in concert with your general plan[5].

Before going down to Madras Lambton had secured the support of Arthur Wellesley, commanding the army in Mysore, who writes to Close from Seringapatam on January 3rd ;

I have received a letter from Lambton, in which he informs me that he has had a conversation with Mr. Webbe [115 n.3], who told him that his plan...had the full concurrence of Government, and that he had been referred to you for the establishment which he will find necessary. ...

He tells me that he shall want some people for the carriage of his instruments, a draughtsman, and a writer, and a young man from the observatory who will assist him in his calculations [241]. ... Webbe desired Lambton to send for the instruments which he was desirous of having from Bengal ; so that nothing remains to be done but to arrange these little matters... and to set him to work[6].

The instruments belonged to Dr. Dinwiddie in Calcutta where Lambton had seen them. They were now purchased by the Madras Government, and despatched early in April [251–2].

[1] Full accounts of Lambton's work from the geodetic point of view have been written by General Walker, *GTS.* I (xv–xxxv), and by Sir Sidney Burrard, ib. XII, 1888, Appx. (1–44). [2] No copy found. [3] *As R.* VII, 1801 (312). [4] Journal, July 10th to Nov. 22nd 1799, BM Addl MS. 13664 (60–113). [5] DDn. 68 (179), 25–12–1799. [6] Gurwood, I (59).

On 6th February 1800 formal orders were issued for the start of the survey, and Webbe wrote in further detail ;

You have been already made acquainted with the intention...to employ you in an Astronomical Survey in the Peninsula [251], but chiefly in the territories lately subdued. ...

A considerable establishment under the direction of Captain Mackenzie having already commenced a detailed Survey of the provinces of Mysoor and the Southern part of the Peninsula, his Lordship is desirous that, without departing from the purposes of general geography which your labours will have principally in view, they may...be made to coincide with those of Captain Mackenzie, so as to enable him with the greater facility to combine the details of his Survey, and to verify the positions of the most remarkable Stations [116]. ...

As the distinct nature of your undertaking will probably make it necessary for you to traverse the peninsula from Sea to Sea more than once, ... a scrupulous coincidence with Captain Mackenzie's plan will not always be practicable ; but...his Lordship forbears...to impose any restriction with regard to the special object of your own survey but such as your own Zeal and experience may dictate. ...

P.S. The Governor in Council directs you to submit...the detailed plan of your proposed survey, in order that it may be recorded[1].

Lambton thereupon submitted his

Plan of a Mathematical and Geographical Survey, proposed to be extended across the Peninsula of India. ...

In a former communication [233, n. 2] I took the liberty of stating...my idea of a survey to be extended from the Coromandel to the Malabar Coast, with a view to determine the exact position of all the great objects that appeared best calculated to become permanent geographical marks...facilitating a general survey of the Peninsula, and particularly the territories conquered...during the late glorious campaign. ... The Surveyors of particular districts will be spared much labor when they know the position of some leading points to which they can refer because, when these points are laid down in the exact situations in which they are upon the globe, all other objects...will also have their situations true in Latitude and Longitude. ...

As my intention is to execute this work upon principles, I believe, totally new in this country, it may be requisite to explain more fully, ... in case it should be the wish of Government...to submit the proposed plan for the examination of scientific men in England.

[After a long discussion of technical details [250–1], he continues ;]

I have now adduced...the principles of my intended survey, ... which...involve many more objects than what immediately appertain to Geography. ... Whenever a cooperation with Captain McKenzie can be dispensed with, I shall then direct my views to the General object of determining the Geographical features of the Peninsula[2].

This was forwarded to the Governor General, together with Mackenzie's *Plan* for the topographical survey of Mysore [91–3], and both were formally approved[3].

As the instruments purchased in Calcutta were not sufficient for the more elaborate operations in view, Lambton wrote to England for others [253], and in the meantime started on the triangulation of Mysore in support of Mackenzie's survey.

MYSORE, 1800–2

Lambton appears to have moved up to Mysore during September 1800, by which time Mackenzie and his assistants had their triangulation and survey well advanced [95–6]. He writes on October 8th ;

After being at Bangalore for upwards of three weeks...to complete the necessary apparatus for measuring a base line, I returned on the 8th instant to Kistnaporum[4], in the neighbourhood of which...I had expectations of finding an extent of country suited to my purpose. The almost incessant rains which have fallen since my arrival there prevented my fixing upon the ground before yesterday. ...

The weather hitherto, since I arrived at Bangalore, has been extremely unfavorable for service of this kind, but I am in hopes that the Monsoon is nearly at an end. Tomorrow I shall make a beginning if the day be at all favourable. ...

[1] MMC. 4–2–1800 ; DDn. 62 (1). [2] BPC. 14–3–00 (10) ; DDn. 63 (1–8), 10–2–00 ; Burrard (3–4).
[3] BPC. 14–3–00 (12) ; cf. abstract, *As R.* VII (312–37). [4] Krishnarājpur, 7 m. E. of Bangalore.

I expect sketches of the country from Captain McKenzie, and shall particularly notice all the leading objects by which his surveys have been regulated[1].

He completed the measurement of his base-line on December 10th, and observed latitude and azimuth at the extremities, which he marked by small masonry pillars [95, 256]. He found Bangalore to be very correctly laid down as to Latitude. I observed four nights with the Zenith Sector and found it to be in 12° 57′ 30″, and only about 8″ different from...Captain Colebrooke in 1791 & 92 [I, 175]. Shevagunga and Savendroog[2], particularly with respect to each other, are very much out[3].

He writes to Close on 23rd December ;

I have received from Lieutenant Warren a sketch of his primary stations in the district of Ooscottah[4] [96], and I shall first determine and compare some of the principal ones before I leave this quarter, after which...I shall proceed to the northward, stretching a considerable distance to the Westward, and take up most of Captain McKenzie's points, a sketch of which I have received from him. ... From a wish to cooperate with him, as well as from the nature of the instruments I am now provided with, I shall be induced to extend my operations much to the Northward [116–8][5].

and again from Sira ;

In three or four days more I shall be able to send you a sketch of my operations, which will take in the country to the eastward of Seringapatam as far as Mallavilly[6], and to the northward as far as Bellagola, where you may remember the great statue [pl. 22][7]. ...

I feel much mortified that I cannot get the situation of Chittledroog without extending my series of triangles...to...within two miles of the Droog, and I find the westing will be so great as to lead me very far beyond what I conceive will admit of accuracy. I have had several communications with Captain McKenzie on the subject[8].

and again the same month ;

I...forward to you a sketch of the operations...from Seringapatam, ... to connect with that place Serah and Bangalore. I have gone as far to the westward as I judged would admit of accuracy in determining the position of places without having recourse to another measurement. ... The sketch is accompanied by three tables...useful to surveyors. ...

The 1st contains the latitudes of the places and stations, and their longitudes from the meridian of Bangalore, from which I compute at present until there is a connection with the Coromandel coast [262]—The 2nd gives the distances, and they are so arranged that a new sketch may be projected therefrom—The 3rd contains a description of the stations, with directions where they may be found.

From these two last the surveyors will derive great advantage, if they have recourse to any two...as a primary distance ; for by doing that they will avoid the trouble of measuring a base line, and their surveys...will always fall into their places on the general plan. ...

Though this is not a work that I wish to be considered as executed with mathematical precision, yet I am not without confidence that when I come to verify the principal points with a more powerful instrument than I have at present, I shall not find them out, either in Latitude or Longitude, more than five or six seconds. ...

My intention is now to return to the eastward...and, if possible, fix upon some points to connect the country above the Ghauts with the Carnatic, which will much facilitate my plan of crossing the Peninsula[9].

He writes to Government on 24th June ;

With respect to the general features of the country, I have endeavoured to give some idea of the ridges of mountains by a slight shade depicting the general ranges, and representing more strongly those only whose positions have been determined ; and I have been careful in observing the Barometer that I might form some judgement as to the relative heights of the places where I had occasion to remain any time. It appears that all that level and regular country seen from the neighbourhood of Bangalore is considerably elevated above that to the westward of the great range of mountains running from Shevagunga. The descent begins after passing that range. ...

Such a vast chain of rocks and hills apparently locked into one another, crossing the course of the monsoons, and dividing an elevated from a low country, will no doubt have considerable influence on the weather and the state of the atmosphere. ... I have been thus particular...

[1] MPC. 24–10–00. [2] Sivaganga, 4550 ft., 17 m. N. of Sāvan Durga, 4030 ft. [pl. 11]. [3] DDn. 63 (23), 1–2–01. [4] Hoskote *tāluk*, 57 G/16. [5] MPC. 9–1–01. [6] Malavalli, 57 H/3. [7] Statue 57 ft. high dated *c.* AD. 983 ; sacred to Jains ; *Imp Gaz.* XXIII (96–7) ; Sravana Belgola, 57 D/5. [8] DDn. 63 (31), 16–6–01. [9] ib. (41–4).

because...this kind of information may afford some slight data to intelligent medical men, who may enquire into the causes of disorders prevalent to the westward of these hills[1].

In January 1802 he asked permission to withdraw to the Presidency ;

Having extended my survey to a considerable distance in every direction from the original measurement, and taken in most of the principal Droogs, Stations, and other noted objects lying between the parallels of 12° and 14° of latitude, and from the Westward of the meridian of Seringapatam to Sautgur easterly, it now becomes necessary that another measurement be made to serve as a datum for the future prosecution of this survey.

As a considerable time will be taken up in constructing a proper plan, and in finishing the tables and other papers, ... I have deferred making out any sketch until I arrive at Madras, to which place I shall now proceed[2].

Some time will be required in preparing the apparatus for the measurement of a base line, which I wish to be as near the Coast, and as near the Latitude of 13°, as circumstances will admit[3].

During September and October 1801 he had the help of James Colebrooke, then commanding the Guides [94, 118, 122] ;

Captain Colebrooke who accompanied me from Bangalore...has sent a plan of his survey of the roads during that excursion. By availing himself of my points as data, he carried on a series of smaller triangles by which the principal places in his plan have been laid down. He frequently compared his triangles with several of my stations as we moved northerly, ... and his results always agreed with mine to within a very few feet[4].

It has already been told how closely Mackenzie kept in touch with Lambton, and made regular comparison between their results. Finding that there were no great differences or errors, he went on and completed his maps and surveys on the foundation of his own triangulation and that of his assistants, without incorporating any of Lambton's work, which had, however, provided a healthy stimulus to the accuracy of their work [115–21]. Lambton himself writes ;

As it has been the wish of the Right Hon'ble the Governor in Council that there should be such communications between Captain McKenzie and myself as might promote the general object of the two surveys, and as my operations for this last year have been chiefly confined to that part of the Peninsula which falls under his immediate direction, I have transmitted to him a general sketch of all my points, which will be followed by the tables of latitude and longitude and of the distances [118–9].

My survey not having commenced in sufficient time to afford him an early advantage of the situation and distances of my stations, he has not derived that assistance from them which may in future be had in those districts where he, or his assistants, have not yet been [3, 112, 121]. ...

I have, however, had an opportunity of comparing many stations common to both surveys, and find a very near agreement, and several distances have been sent to me by Lt. Warren, Mr. Mather, and Lt. Arthur, which have been determined from their own data, and the differences between those distances and mine were generally very trifling, ... considering the difference of the instruments used [207–8][5].

Though never used for mapping, or embodied with his later work, this Mysore work gave him a very useful trial run, a chance of getting his small staff organised, and a thorough knowledge of the Mysore plateau that was of great advantage when he came up later with his new instruments.

COROMANDEL COAST, 1802–3

Lambton's next task was to determine the length of the degree in both directions, which he had described as an essential preliminary to any extensive trigonometrical survey [250].

In 1787 General Roy had pointed out the lack of measurements of this nature in equatorial regions, and Dalrymple and Rennell had welcomed the suggestion of such a measurement on the Coromandel Coast. The Directors had decided that the work should be entrusted to Burrow in Bengal and Topping in Madras, and had actually placed orders for suitable instruments. These plans had fallen

[1] DDn. 63 (34–41). [2] Map, MRIO. 132 (3, 4) ; Memoir, DDn. 61, 10–3–02 & BPC. 3–3–03 (4).
[3] From Sautgur, 12–1–02 ; MPC. 15–1–02. [4] DDn. 63 (59), 13–2–02. [5] ib. (61–3), 10–3–02.

through, and, though Burrow had made some measurements in Bengal, his death occurred before he was able to bring them to completion [I, 164–6]. It is doubtful whether any of this was known to Lambton ; he certainly never makes reference to it.

In 1802 he took steps to measure a meridional arc near the coast preliminary to more extensive operations from east to west across the peninsula. His first consideration was to measure a base-line ;

As it is necessary to make another measurement as a new datum for extending this survey, I wish to fix upon some convenient part of the Country, near the Latitude 13°, and not very far from the Sea Coast. ... This Base will be of great importance, not only in connecting what has been done above the Ghauts with what is to be carried on from the Sea Coast, and in laying a foundation for a General Survey of the Carnatic, but it is upon this Base that I wish to proceed for determining the length of a degree on the meridian and on the great circle perpendicular thereto, from which a scale will be obtained for computing the latitudes and longitudes. ...

I wish to be as particular as possible in the choice of the ground and in the accuracy of the measurement, and to avoid any of those impediments which may happen from rains or other causes [205, 256]. I propose to make an excursion for the purpose of thoroughly examining the neighbouring Country...before I commence the measurement ; at present I am preparing the apparatus, which I hope will be completed in a few days more[1].

He measured his base at St. Thomas' Mount during April and May [256–7], and this he regarded as the first operation of his great survey. His next step was to reconnoitre for his triangulation ;

My apparatus not being arrived, it will be out of my power to commence on the original and intended scale. I shall, notwithstanding, prepare to move to some distance from Madras... with a view to examine the country, and find the most convenient stations for determining the length of a degree on the meridian, ... and in doing that I shall endeavour to take in most of the Principal objects to the Eastward, perhaps as far as the Sea Coast[2].

The Great Theodolite arrived in September after an adventurous journey [253], and after overhauling it Lambton commenced observations on 27th September ;

I am now proceeding on the survey of the Peninsula, and have received such Instruments from England as to enable me to prosecute it on the principles originally proposed. ... Some weeks ago I made an excursion down the Coast as far as Pondicherry with a view to examine the country, and choose the stations best adapted for this purpose. ... My intention is...to make a general survey of the country falling within the parallels of latitude to which I shall extend the meridional arc. ... Lieutenant Warren has now joined me, having completed his survey of the Colar District [119][3].

Whilst Lambton observed his main triangles southwards to the neighbourhood of Cuddalore, Warren observed secondary triangles and filled in topographical detail [239, 258]. For the area to the north he was to

repair to the northern stations, ... lay down Pullicate, and from thence go westerly and ascertain as many points as you conveniently can...till you think you are near the Meridian of Vellore, and I shall endeavour to have a flag to the northward which will enable you to connect your triangles with Poonauk hill, Sholangur, and Naggery Nose [pl. 16][4]. You will then move down to Vellore, intersecting what objects you can in the way, and in your progress endeavour to depict the general ranges of the mountains[5].

The main triangles, and observations for latitude at the terminal stations, were completed by April 1803, and at the end of July Lambton asked for a second assistant ;

Being now preparing my Public Report, which will be accompanied by a general plan[6] exhibiting all the great stations, and all the principal places and objects falling within the parallels of Cuddalore and Pullicate, it has occurred to me how very much such a sketch... would be improved by taking in the great rivers, which indeed are the most distinguished outlines in Geography. ... Should this plan be approved of, an additional person will be required to carry it on, who at the same time can assist in filling up the great intervals, and extending the secondary triangles [212, 238].

It may be proper to mention that I expect another Instrument from England, and that I

[1] DDn. 63 (61), 10–3–02 ; MPC. 3–3–03 (3). [2] ib. 2–7–02. [3] DDn. 62 (35), 10–10–02. [4] Sholighur, 57 O/8 ; Nagari Nose, 2813, 57 O/11 ; *Imp Gaz.* V (403). [5] DDn. 63 (84), 20–5–03. [6] Submitted Aug. 1803 and pubd. *As R.* VIII, 1805 (137–93).

can venture to recommend a gentleman fully competent to the use of it, and who in the meantime is sufficiently provided to render himself of immediate service[1].

His proposals were approved, and "Lieutenant Kater of His Majesty's 12th Foot" was appointed "to be an Assistant in the Astronomical Survey".

Though this term *Astronomical Survey* was often used by Government in orders and correspondence, Lambton generally described himself as being "On Geographical Survey", or more often as "*On General Survey*", which latter he continued to use right up to 1815. The expression *Trigonometrical Operations* appears on his charts and memoirs, but he was by no means content to confine his attention to geometrical figures [244];

> The trigonometrical part of this survey is the foundation from which all distances and situations of places are deduced; a true delineation of the river vallies, ranges of mountains, with some noted points near the ghauts and passes, will also be a foundation for more minute topographical surveys such as are immediately wanted for military purposes[2] [245].

ACROSS THE PENINSULA, 1803–6[3]

Having measured his first arc along the meridian, Lambton was free to start the more ambitious measurement from coast to coast across the plateau of Mysore and the Western Ghāts. The true width of the peninsula had long been a matter of speculation owing to the uncertainty of longitude observations along the coasts. It had been discussed at length by Kelly, Rennell, and Colebrooke [I, 178–9], and though some continuity of overland measurement had been obtained south of parallel 12°, no continuous line had been possible through Tipu's dominions further north. Lambton's triangulation was to the first direct measurement of any precision[4], and would at the same time furnish the length of the degree perpendicular to the meridian. He obtained official instructions to connect

> the Coromandel with the Malabar Coast, and afterwards to extend...operations Southerly and Northerly, in order first to lay a grand basis for a General and Military survey of the Peninsula. This being intended as a Ground Work for all other surveys, of whatever denomination, ... particular attention should be given...to determine...the distances and positions of certain stations best calculated to forward the completion of the design. ...
>
> You will...keep a journal containing Observations and Remarks on the appearance and resources of the country, its roads, its supply of water, and whether favorable for military movements; also to represent its general features, such as Rivers, Valleys, Passes, Ranges of mountains, state of the Fortified places and, in short, to notice every circumstance that may afford useful information in time of War[5].

Six months later, after receiving the first reports of Mackenzie's survey, Government withdrew the second part of these orders, and confined work to that proposed in the original Plan[6] [246].

Warren was sent forward during the monsoon of 1803 to select stations beyond Vellore, Lambton giving him the following instructions;

> I refer to two points which I determined previous to my coming to Madras. The one is on a high hill near Pilloor[7], on which a flag is now flying. ... The other point is on a hill near the village of Tailcoor on the west bank of the Pooni river. It is nearly west from the Pilloor flag and distant 66,723 ft. These two stations will enable you to fill up what is wanted to the northward as high as Pullicate.
>
> I have sent a flag to Vellore hill, which you will be able to descry from both these points, and there is also a flag on Kalas Ghur[8]; I have likewise sent another to wait for you at Pilloor. With these you may take in several objects lying between the northern stations and Vellore. ...
>
> The next service...after you come to Vellore will be to visit the station on Kalas Ghur, and examine...the appearance of the country to the westward, and whether it be more favorable than the country west of Curnak Ghur[9] for obtaining a long distance to connect the next

[1] DDn. 63 (86), 29–7–03. [2] ib. (90), 22–9–03. [3] ib. Burrard Appx. (17–23). [4] Mackenzie would have been thrilled to have completed his connection first [104]. [5] DDn. 62 (56), 22–10–03. [6] DDn. 64 (23), 12–5–04. [7] Pullur, 1908 ft. 57 O/8 [pl. 11]. [8] Kailasagarh, 2739 ft., 57 P/1; *Imp Gaz.* V (404). [9] Karnatigarh, 3180 ft., 57 P/2.

meridian line, and whether you have a distinct view of any mountain lying as nearly west as possible, and at as great a distance as you may suppose blue lights can be seen [259].

You will also observe whether there be any mountains to the N.W. or S.W. which you think will answer for stations, so as to form with Kalas Ghur a Base for computing the great side, a distance from Kalas Ghur to the western point where the next meridian is meant to be[1].

Lambton himself started observations in October and worked westward till July 1804, whilst Warren carried forward secondary triangles and prepared fresh main stations in advance, besides working to the south to fix

the ranges of mountains in the Barmahl, and also the passes; and, whatever well-defined objects may be in the vicinity of those passes, let them be accurately laid down, that they may serve as data for more minute topographical and military sketches[2].

From Bangalore he sent in a report with

a plan of all the principal places...between the parallels of Cuddalore and Pullicate, and extending as far Westerly as Savendroog[3] [pl. 16]. ... The representation of the features of the country has been done...in a manner consistent with the original plan. ... This part of the service has fallen chiefly within the province of Lieutenant Warren in carrying on the secondary triangles.

The Rivers are only sketches, excepting the Pallar, which has been surveyed by Lieutenant Kater from the mouth to Vaniambaddy[4]; above that to the source has been taken from the Mysoor Survey, but as Mr. Kater was called off to assist on other parts of the work, and the Rivers not being considered in my original instructions, I have withdrawn him from that service altogether.

My object is now to proceed as soon as the weather will permit, and continue the operations westerly to the Malabar Coast, which I hope to see in the course of December next[5].

Warren spent May to July measuring a new base-line near Bangalore, on a better site than the old one of 1800, and connected it to the main triangulation [257]. Whilst he then assisted Lambton with computations Kater took over the advance triangulation;

As a connection between Savendroog and Mullapenbetta by a series of triangles is necessary ...you will...take up the stations at Savendroog and the Muntapum, N. of Bangalore, as data, and proceed to...Devaroydroog[6] [pl. 16], and observe...whether it be proper as a great station. ... From Rungaswammy Pagoda you will proceed to choose such stations as you may think most convenient for carrying you in the shortest time possible to Mullapenbetta. ...

After ascertaining the situation of Mullapenbetta, it will be necessary to know whether Savendroog be visible therefrom; if not, another station must be chosen so as to become a meridional station. ... This done, ... you will endeavour to lay down such points to the westward as may answer for great stations to carry me to the sea; but take care and be in the way to receive my directions when I arrive at Savendroog, which may be near five weeks hence[7].

In October Warren was sent to the south-west;

You will...take up the points you left off and continue your triangles in a westerly direction, extending southerly as near to the parallel of Cuddalore as circumstances will permit, and continue till you arrive at the Malabar Coast. ...

I shall move from this station [near Mysore] to...a hill nearly west, and from thence northerly for...ascertaining...the most prominent objects at the head of the Ghauts...to enable you to carry on a series of Triangles along the Sea Coast from Tellicherry, Mount Dilli, etc., if practicable, in a northerly direction as far as Condapoor[8] [pl. 16]. ...

My intention is to carry the principal triangles westerly so as to intersect the flag staff at Mangalore previous to your arrival there [104]. ... In the meantime you will act as you find most convenient, keeping in view the chief object, viz., an accurate determination in Latitude and Longitude of as many principal places on the Sea Coast as can be conveniently taken in[9].

Warren reached the coast and fixed Tellicherry, but was then withdrawn to take over charge of the Madras Observatory [195].

Lambton thus describes his own triangulation across the Ghāts [pl. 16];

After the observations were completed at Mullapenabetta in November 1804, the western monsoon being then over, and the favorable season on the Malabar coast approaching, ... I found that my intended direction would take me across the Bullum district[10], which is a part of the Ghauts forming a curve convex to the eastward and, in consequence, is at too great

[1] DDn. 63 (88–9), 1–8–03. [2] ib. (96–7), Dec. 1803. [3] Savandurga, 4020 ft., 20 m. W. of Bangalore. [4] Palar R., 66 D/3, to 57 L/10. [5] DDn. 62 (65), 24–7–04; MPC. 3–8–04. [6] Devarayadurga, 3896 ft., 8 m. NW. of Tumkur. [7] DDn. 63 (107), 6–7–04. [8] 48 K/10. [9] DDn. 63 (114), 24–10–04. [10] 48 P/9, 10.

a distance to discover any object on the sea coast ; for I had all along entertained a hope of finding two or three stations on the tops of these high mountains from which to intersect the flag staves at Cannanore, Tellicherry, and Mangalore.

For the purpose of selecting stations I had detached Lieutenant Kater...who, after encountering many difficulties, succeeded in the choice of two, one on the top of Balroyndroog in the Bednore province, and the other on Koondhully, a mountain in the Koorg. ... These stations, however, being too remote from the sea, I decided on descending the ghauts, and on the distance between them as a base a series of triangles was carried through to Mangalore, and thence down to the coast to Mount Delli and Cannanore. ...

The great extent from Bangalore to the sea coast required that another base should have been measured...but circumstances...prevented it till the season became so far advanced that every other object would have been lost. I had to fix the meridian at Balroyndroog and to observe zenith distances at Paughur, the intended northerly extremity of my meridian arc, and, by the time I arrived at the latter place, it was the end of April, and very shortly after that the monsoon set in[1].

Kater was deputed to run secondary triangles from Mangalore to Coondapoor, to fix principal points along the coast as far north as parallel 14°, and then to move easterly, fixing " all the principal forts and droogs, ... Bednore and Chittledroog to be particularly noticed". He got as far as Lambton's station at Paughur, but was then " obliged through illhealth to relinquish the Survey " [313].

Lambton himself worked back in a north-easterly direction, by "Cowleydroog" towards Paughur[2], a "well known droog on the borders of the Ceded Districts, and nearly in the meridian of Savendroog"[3]. Here he spent the month of May making observations for latitude, making it the northerly station of the meridional arc, the beginning of the Great Arc of India [241, 260].

These meridional operations were begun in 1805. The base near Bangalore, measured in 1804, was the first foundation. ... In 1805, on my return from the Malabar Coast, the meridional triangles were begun at Paughur and Yerracondah[4], and brought down to the base near Bangalore, from which other triangles had been extended southerly in 1804 for the purpose of obtaining sides of a great length for measuring a perpendicular arc, but which answered exceedingly well for the meridional series[5].

He again spent the rains at Bangalore, working up computations and reports, and before starting on a second visit to the west coast sent in his charts on which, besides the interior positions, a great number of places on the Malabar Coast are laid down. Those to the southward of Mangalore, Tellicherry excepted, have been fixed under my immediate inspection by extending a branch of the principal triangles. ... Those to the northward... by Lieutenant Kater ; ... Tellicherry was laid down...by Lieutenant Warren.

The great triangles connecting Fort St. George with Mangalore direct have been executed by myself...over a tract of country in many parts extremely difficult. ... As fixing the longitudes of these places on the Malabar Coast is unquestionably one of the most important objects of this survey, I shall...move again to the westward by a southerly route as far as the Koorg mountains, with a view to verify the truth of the former triangles. ...

After that is completed, my intention is then to proceed to the Coimbatore country, ... to make observations corresponding with others made at Paughur...for ultimately fixing the latitudes, and after that to Kylasghur, near Vellore, for...continuing the observations for the longitude to the observatory at Madras[6].

Lambton, being now alone except for two lads from the observatory school[7], started out from Bangalore on the return of favourable weather, and took

a southern series of triangles...through the Koorg to Mount Delli, which was rendered practicable by the assistance afforded me by the Koorg Rajah, to whose liberal aid I am indebted for the successful means I had in carrying the triangles over these stupendous mountains. Several beacons had been erected on commanding situations pointed out by me previous to my descending the ghauts, some of which were distinctly seen from every part of the coast, and, one of them...being visited as a station, ... I was enabled thereby to intersect the flag staves at Cannanore and Tellicherry, and also a signal flag on my former station on Mount Delli. This branch of triangles was carried on in the beginning of 1806, and commenced from Mullapunnabetta [239] and Mysoor hill[8].

[1] *As R.* X, 1808 (294). [2] Pavugada, 57 F/12. [3] DDn. 63 (115), 5–2–05. [4] Urakonda, 2189 ft. 57 F/11, 25 m. NE. of Pavugada. [5] *As R.* XII, 1818 (296). [6] DDn. 63 (174), 28–8–05 ; MPC. 13–9–05. [7] De Penning & Lawrence, aged 21. [8] *As R.* X, 1808.

Closing at Mangalore in February, he returned to Bangalore and extended his meridional arc south to observe latitude and measure a base-line near Pachapālaiyam. In May he marched north once more to establish a new terminal station[1] in place of Paughur, which seemed to be disturbed by local attraction [261]. He returned to Madras in October 1806, after an absence of nearly three years.

Between 1802 and 1806 Lambton had observed a series of primary triangles over a degree in length both on the east and west coast, and connected these by triangles across the peninsula[2] [3–4, pl. 16]. He had measured three base-lines, St. Thomas' Mount, Bangalore, and Pachapālaiyam. By astronomical observations for latitude and azimuth at selected stations he had obtained a value for the length of a degree along the meridian, and four values for the length of a degree perpendicular to the meridian, besides determining the direction of the true meridian at six dominant stations.

He had further measured an arc of meridian more than three degrees in length astride meridian 78°, the first section of the Great Indian Arc that eventually stretched from Cape Comorin to the Himālaya ; from astronomical observations at the terminal stations of this central arc he obtained further values for the length of the degree.

His assistants Warren and Kater had filled in the greater part of a belt between parallels 12° and 14° with secondary triangles and intersected points, but had not been able to complete the hilly area of the Western Ghāts, nor the country between the Ceded Districts and the east coast.

The width of the peninsula was found to be approximately 360 miles along parallel 13°, against 404 given in Rennell's map of 1793, and 386 by Colebrooke's calculations of 1800, and approximately 365 by modern maps [I, 179 ; II, 238].

With the assistance only of De Penning and Lawrence he had kept his elaborate computations up to date, and was able to submit his final reports and maps by June 1807[3]. The technical results will be more fully discussed in another chapter [258–62].

SOUTH PENINSULA, 1807–10

As Government had accepted Lambton's proposal that his triangles should "form a complete skeleton of the Peninsula from the latitude of fourteen degrees to Cape Comorin"[4], he started towards the south in the autumn of 1807, extending his primary triangles down the coast from Cuddalore to Nagore, near Negapatam ;

> The work was here brought to a standstill owing to the height and the thick growth of the palm trees which everywhere obscured the view. The difficult and dangerous method was adopted of building scaffolds on the tops of the highest pagodas, and of hoisting the heavy apparatus up by machinery constructed for the purpose, but without success ; no stations whatever could be found with the necessary mutual visibility, and it was with some difficulty that...the Pagoda at Nagore was laid down [244][5].

From Nagore he ran triangles eastward to Tanjore, observing at ten pagodas. A base-line was measured at Tanjore during July 1808, but work was then stopped by an accident to the great theodolite.

> In raising it in its case to the top of one of the pagodas, the bearing rope, which kept the weight from striking against the side of the building, snapped when it was half-way up, and the instrument, case and all, struck with a violent crash on the side wall. The blow was received on the tangent screw and its clamp. The case being insufficient to protect it was broken, and the limb, instead of being a beautiful circle, was so distorted as to render it to all appearance worthless.
>
> Any person but my predecessor [writes Everest] would...have given the matter up as utterly desperate ; but Colonel Lambton was not a man to be overawed by trifles, or to yield

[1] Bommasandra. [2] angles observed 1803–4, TS. I (104). [3] *As R.* X, 1808 (290–384). [4] DDn. 63 (148), 3-6-07 ; MPC. 20-6-07. [5] Burrard (27).

up his point in hopeless despondency without a struggle. He proceeded to [Trichinopoly][1], where there was a large establishment of ordnance artificers, all of whom the Madras government placed at his disposal with the most liberal and unrestricted confidence. Here he shut himself up in a tent, into which no person was allowed to penetrate save the head artificers.

He then took the instrument entirely to pieces, and, having cut on a large flat plank a circle of the exact size that he wanted, he gradually, by means of wedges and screws and pullies, drew the limb out so as to fit into the circumference ; and thus in the course of six weeks he had brought it back nearly to its original form. The radii which had been bent were restored to the proper shape and length by beating them with small wooden hammers[2].

Though Lambton's own work on the main triangles was thus held up, he had by now got several capable assistants, whose work went on. At the end of 1807 he had been given four officers [4, 317] from the senior class of the Military Institution for "secondary operations", started down the coast through Tranquebar ;

[Your] Survey is intended to constitute the basis of detailed military surveys hereafter, and an important advantage will be derived...from making the points determined by you as numerous, and near each other, as may be practicable. As the detailed surveys will be constructed upon a large scale, the contiguity...of the points...will materially facilitate their operations.

You will probably pass over countries of which the Geographical knowledge which we possess is most imperfect and limited ; and...the Commander-in-Chief would wish that you should direct your attention to a delineation of...those countries, if that measure shall not... interrupt the primary object of the Survey [245][3].

One of these officers, James Bayley, ran a series of secondary triangles westward from the new base at Tanjore to connect with the Pachapālaiyam base [257], and continued across the Ghāts to Calicut on the Malabar coast. Another officer, probably Swinton, ran a series north and south through Tanjore. Tulloch and Chavasse filled in the general topography by minor triangulation. The following are Lambton's orders to Tulloch in October 1808 ;

You will...fill up the entire space between Mr. Bayley's stations...and the parallel of Chillumbrum[4]. ... I could wish that particular attention be paid to the great roads and that, by selecting as many stations as you can contiguous to them, you may be enabled to sketch them in. ... I could also wish that similar attention be paid to the rivers, and especially the Cavery. ... You will likewise be particular in giving a general representation of the passes through which the great roads lead, and, by choosing some stations on the tops of the highest mountains and intersecting all the prominent objects upon them, you will be able to give a tolerable representation of the general features of the country. ...

You must...connect your operations with those of Mr. Bayley, so that a complete network may be formed, but, ... as the work is more of a general than a topographical nature, it will be necessary for you to move with considerable rapidity as the *belt* formed by the combined operations of Lieutenants Bayley, Chavasse, and yourself, must be continuous to the Malabar Coast.

I have mentioned the parallel of Chillumbrum as a general limit to the northward, but it may frequently happen...that...you must occasionally go beyond it. Salem for instance, ... and in the Coimbatoor the great road from Bhavany...to the top of the Guzzlehattee pass[5], will take you considerably to the northward of that parallel[6].

Chavasse and Tulloch were relieved by Hodge and Riddell after the first season, and during the next two years most of the peninsula south of parallel 12° was covered with a net of triangles controlled by principal and secondary chains [pl. 17].

Lambton himself was held up by repairs to the great theodolite till October, when he set out to resume work on his great central arc, working south from the base at Pachapālaiyam to Punnae near Cape Comorin[7]. Riddell and Swinton accompanied him for secondary work.

Progress was interrupted by disturbances in Travancore, Lambton acting as military engineer in the operations which led to the forcing of the Aramboli

[1] Everest here wrongly gives Bangalore, but in another place gives Trichinopoly, which fits. [2] Geo. Everest (46). [3] From QMG., 22–12–07, DDn. 91 (27). [4] Chidambaram, 58 M/11 ; lat. 11° 25′. [5] now the Bhavāni–Kollegal road, 58 E/9, 10. [6] dated Trichinopoly, 11–10–08 ; DDn. 63 (169–70). [7] Punnae, 8 m. NE. of Cape Comorin.

Lines in February 1809[1] [132]. Swinton and Riddell were placed under Arthur's orders to push on the survey of Travancore till released in May to resume work under Lambton to the east of the Ghāts.

Meanwhile Lambton was freed to measure a base-line at Pālamcottah during February and March, and take astronomical observations at Punnae during April and May. He made headquarters at Pālamcottah till August, and at Trichinopoly from November 1809 till January 1810. Much of the actual observation at principal stations south of Madura was carried out by De Penning, one of his country-born assistants[2].

In October, Swinton, with Peter Lawrence in attendance, carried a secon dary service from Pālamcottah eastward to Rāmeswaram, and then, whilst Lambton withdrew to Pondicherry, took over the great theodolite, and observed a principal series from Cape Comorin northwards through Travancore and Cochin as far north as Crānganūr[3] [pl. 17] where, in April 1810 he measured a base-line, and in May took astronomical observations at Trichūr.

After completing his main series across to the west coast at Ponnāni, Bayley was employed on a series from Dindigul to the east coast, whilst Hodge and Riddell worked further south through Rāmnād. It was never possible, however, to connect up this work by any coastal series between Negapatam and Rāmeswaram, and the flat country of Rāmnād, covered with palm trees, had to be left blank.

Lambton gives the following account of all this work ;

In addition to the great triangles carried down by me from Cuddalore (where they formerly terminated) to Negapatam, there has been a series carried from Negapatam and Tranquebar, entirely through the Tanjor and Tritchinopoly districts, to the middle of the Coimbatoor country where I left off in 1806. In these I have been assisted by Lieutenants Bayley and Swinton, who at the same time, with the assistance of Lieutenants Chavasse and Tulloh, filled up the intervals.

From the Coimbatoor, Lieutenant Bayley, with a part of my apparatus and establishment, continued the triangles entirely across to Paniany and Calicut on the Malabar Coast, still continuing to fill up the intervals. ...

Under my own immediate direction the great meridional triangles, which commenced in the Ceded Districts in a former year [240], were continued from Coimbatoor to Cape Comorin in the course of 1808 and 9. From these again a series has been extended from Cape Comorin as far as Ramiserum to the eastward, and to the westward through the Travancore, Cochin, and a part of South Malabar, till they fell in with Lieutenant Bayley's operations of the preceeding year. All these last were executed under the direction of Lieutenant Swinton, whom I trusted with a part of my grand apparatus, and a considerable part of my establishment. That service was carried on from the latter end of 1809 till the commencement of the monsoon on the Malabar Coast in 1810. Thus was completed the great skeleton of the work[4].

In July 1810 he reported from Pondicherry, which had been his headquarters for the past six months, that

Lieutenants Bayley and Riddell have been employed in taking up data furnished by me, and filling up the whole extent of country, commencing at the great mountains which divide the Travancore and Cochin Districts from Tinnivelly and Madura, and terminating on the sea coast from Ramisseram to Point Calimere. This takes in the Tinnivelly, Madura, the Murwar and Tondiman's Districts [147]. Lieutenant Hodge has been acting in conjunction with them, but has been sick for this some time past.

All their operations are now nearly at a close, when they will proceed hither to assist me in combining the whole of their labours. I am now preparing the plan for that purpose. ... That plan will include the whole of the Peninsula from Cape Comorin as far north as Cuddalore on this Coast, and Calicut on the coast of Malabar. ...

Mr. Swinton is now on his way to join me at Pondicherry. His operations will form a part of my General Report, which will include the higher branch of this Survey.

In another report Lambton says that this main triangulation

forms the foundation of all other surveys, and has been executed with great care, and with the best English Instruments. ... It is to the Geometrical or higher branch, of this survey

[1] Closing the passes into Travancore, from 10 to 15 m. north of Cape Comorin. [2] Dates recorded on chart of MRIO. Misc. 1–0–14 [264]. [3] DDn. 63 (244), 14–12–10. [4] To QMG.; DDn. 63 (217–9), 10–7–10.

that my most particular attention has been directed, because it is, or ought to be, the foundation of every other [233–4][1] . ...

The assistant revenue surveyors based their district surveys on his triangles ;

I have had an opportunity of noticing these young men who are employed under the Collectors in different provinces, and I have been much gratified with the methods of carrying on their respective surveys, and I am confident that their labours will, when combined, contribute most materially to the filling up and completing of the General Survey, which I hope will soon be in that advanced state as to exhibit in one view the combined services of every description of persons employed, and particularly those who have been educated at the surveying school [139, 145][2].

The network of triangles, he notes,

is not so entire as I could have wished owing to the difficulty we met with from the flatness of the Tanjore and Marwa[3] countries, for the face of those countries being covered with numerous and lofty topes we were reduced to...selecting the highest pagodas for stations ; of constructing scaffolding on the topes of the Coverums ; and of hoisting up the heavy apparatus [241]. By these means we were enabled to connect Tranquebar and Negapatam with the pagodas in the Fort of Tanjore, and thence with Tritchinopoly rock and the high lands in Tondiman's country. The southern part of Tanjore and the East of Murwa are therefore left imperfect, but the basis afforded by these triangles has enabled the Revenue Surveyors to finish the district of Tanjore [146-7], and I had, besides, a series of Mr. Topping's triangles by which I fixed the position of Point Calimere [I, 102–3].

The Coast from the south of Tanjore to the Peninsula which extends to Ramiseram has been laid down by the gentlemen who were at that time attached to me, from smaller triangles engrafted on these exhibited in this sketch.

It is to be regretted that I had no previous knowledge of those countries, for many stations were afterwards discovered which would have answered for the large instruments, and, if I succeed in finishing the northern part of the Peninsula in the manner I expect, it may yet be worth while making another attempt, particularly as there is a blank on the Malabar Coast from Calicut to Tellicherry (embracing the Wyenaud) [123, 163], which I intend to fill up should time and circumstances permit. This blank was occasioned by the setting in of the west monsoon in 1810[4].

The report sent in with the geographical map[5] [263, pl. 17] was

accompanied by a memoir giving a short description of the different districts, such as may be useful in a military point of view. ...

The southern part of the Peninsula was filled up chiefly by Lieutenant Swinton from Palamcottah to Cape Comorin, and also a considerable part of the country from Dindigul to Palamcottah which came within the limits of my own triangles, and the remainder, which completed the entire country from the western mountains to the eastern ocean, ... was the joint labours of Lieutenants Bayley and Riddell, and latterly Lieutenant Hodge, all depending on my data[6].

The road and backwaters in Travancore and Cochin have been copied chiefly from what Lieutenant Swinton could have a sight of from Lieutenant Arthur [132], ... but all the positions on the sea coast, with several other points in the interior, are determined by the great triangles. The rivers in Tanjore, and the Coleroon as high as Seringham, I had from Captain Caldwell and the Revenue Surveyors in that district, both filled in upon the skeleton I sent them [146]. ...

The survey was considerably delayed by the troubles in Travancore ; I was myself with the Army till the lines at Arrumbully were taken, and Lieutenants Swinton and Riddell were afterwards in that country during the whole of the war. ...

Lieutenant Swinton's remarks on the Travancore and Cochin Districts, being so minute, I thought it was but just to send them in his own words , I was not myself in that part of the country[7].

Lambton himself regarded the general survey and the general map as a very important part of his labours, though geodesy was "the higher branch" which remained entirely in his hands[8] ;

[1] DDn. 63 (221), 24–7–10. [2] ib. (139), 16–4–09. [3] Country of the Maravans, a people of Madura, Rāmnād, and Tinnevelly [162]. [4] DDn. 63 (279), 11–2–12. [5] MRIO. 145 (19, 20) 8 m. to inch, with reduction 24 m. scale. [6] Lists of charts ; DDn. 246 (33–4, 54) & 63 (257) ; Register of Triangles & Computations, Bayley & Hodge, Madura, IO. Maps. MS. 26. [7] DDn. 63 (244–8), 14–12–10 ; final charts and reports despatched from Masulipatam 11–2–12 ; ib. (272). [8] Burrard makes but little reference to the geographical work.

I shall offer this plan as a specimen of what the higher branches of my survey may be applied to, and how far practical science may be combined with publick utility, and it will be gratifying to me, after having extended my operations from Cape Comorin to the banks of the Kistna, to see them become the foundation of various useful works. ... I shall feel peculiar satisfaction if, while my labours are directed to the advancement of science in general, they may at the same time contribute to the more immediate benefit of my country[1].

What I am most anxious for at present is that this survey should proceed all others, that data may be ready prepared, and the work become the legitimate foundation of every other survey, whether geographical, military, or statistical. The great expediency of working and combining the ordinary surveys upon such a basis will, I trust, be sufficiently evident from what has been done in the Southern Provinces[2].

NORTHWARD EXTENSION

Having completed his general survey of the south peninsula, Lambton obtained permission to extend work to the north [4]. He was now ordered to restrict his work to the trigonometrical skeleton proposed in his original *Plan*, and with two assistants only, Bayley and Riddell,

he proposed to extend the triangles up this coast as far as Masulipatam ; on the coast of Malabar, from Koondapoor in Kanara to Goa ; and up the middle of the Peninsula, from the northern confines of Mysoor where I formerly left off [241] to the banks of the Kistna ; and I am in hopes of completing the first and last of these series in the course of the present year.

The operations along the Malabar Coast must be the arrangement of another season, as the severity of the Monsoons on that side of the Peninsula admit only of a few months in the year for field service.

When these series are finished, it is my intention...to connect them to the northward by going direct from Masulipatam across the Peninsula through the Ceded Districts, a part of the Nizam's and Peshwa's dominions, a part of the Soonda district, and finally close with the western triangles at Goa. This being completed, the skeleton of the Peninsula will be formed as high as the latitude of 16° ; every position on the two coasts will be ascertained with mathematical precision, and the middle series will serve as a foundation from which to branch out to the east and west, for laying down every place of note, and may be continued northerly without limits, for the double purpose of furnishing data to future survey, and for correcting and extending the geography of the countries beyond the Kistna, of which we have but a very imperfect knowledge. ...

I hope I shall be able to leave this in the early part of next month[3].

Leaving Madras in February 1811, he took his party up to the Ceded Districts to start work from the northern end of his central arc. As Bayley was called off for the Java expedition, Riddell was deputed to observe the main triangles of the great arc northwards, whilst Lambton himself, with the assistance of Hodge who had replaced Bayley, measured a base-line near Gooty, about 40 miles south of Adoni, and made the necessary observations for latitude at a near-by station[4]. On conclusion of this important work he deputed Hodge to find a connection with Garling's work on the east coast

in the neighbourhood of Nellore [127], ... and extend the triangles along the sea coast, and to a certain distance into the interior, for the purpose of selecting stations for the large Theodolite. ... You will at the same time endeavour to define the line of coast by smaller triangles, depending on the common theodolite.

When you have gone as far north as Ongole, you may quit the sea coast and direct your steps to the westward, keeping the parallel of fifteen degrees as a mean guide, and attend chiefly to the selection of stations for the great triangles. This you may do till you meet Lieutenant Riddell, who will be carrying on the primary triangles from this to the eastward, keeping the same parallel for his guide. When you fall in with him you will join him[5].

Meanwhile Riddell commenced at Yerracondah, where Lambton had closed work in August 1806 [241], and carried the great arc beyond Adoni by the end of May. He then ran a longitudinal series eastward towards Masulipatam, meeting

[1] Memoir, DDn. 85, 14–12–10. [2] DDn. 63 (251), 28–1–11. [3] Camp near St. Thomas' Mount ; 28–1–11 ; DDn. 63 (251). [4] *As R.* XII, 1818 (294 *et seq*) ; Burrard (33–6). [5] DDn. 63 (266), 20–5–11.

Hodge on the way. Early in September Lambton was called on to release them [322] and replied ;

I mentioned the end of August as the time which I could dispense with the services of Lieutenants Riddell and Hodge. The severity of the weather, and the constant fogs which concealed the tops of the mountains have, however, impeded their progress very considerably, and...they will not have completed what I had proposed before the middle of October, or the setting in of the Monsoon[1]. Lieutenant Riddell has by this time but just reached the Sea Coast, having brought down from the Ceded Districts a belt of Triangles connecting Gooty, Bellary, and Adoni with Ongole and Nellore. ...

Lieutenant Hodge in the meantime, having explored the Country from the South of Nellore to the Guntoor District for the purpose of preparing great stations, and...laid down the line of the Coast, the two parties are now met, and the stations being all selected, it only remains to carry the triangles through...and...to connect if possible Masulipatam. ... It is with a view to have this work completed before the approaching Monsoon that I must request a further continuance of these Gentlemen's labours[2].

Government was, however, adamant, and insisted on the release of both officers, not only that they might spend the regulation period of service with their military units, but also to reduce the expense of the survey ;

It would no doubt be desirable that the series of triangles along both Coasts of the Peninsula should be completed, as well as that the meridional series should be continued, ... but...it may be practicable...without the aid of European Assistants. ...

The primary object of your survey was to extend a series of triangles over the Peninsula as a foundation for future surveys, and the series...which you commenced in Mysore and carried across the Peninsula...embraced...every object which was at first held in view, but, from the period at which a party of Officers from the Military Institution were placed under your orders, ... secondary triangles have been engrafted on the principal ones. ... The latter object ...appears...foreign to the original design of your operations, and...should be now set aside [238, 242].

In consideration, however, of the delays which have been experienced by the severity of the weather, ... The Honorable the Governor in Council will consent to Lieutenants Riddell and Hodge being permitted to remain with you until the 1st of December next. ... It is hoped that the services of the two assistants of the late Revenue Establishment, who have been attached to you from the commencement of your labors, will be of essential use to you in carrying on the details[3].

For the past year Lambton had done none of the triangulation himself as he had been fully engaged on measuring the base-line at Gooty, making astronomical observations, and working out his computations. He had now moved down to Masulipatam where he completed the report on his work in the south peninsula [244].

He accepted Garling's work of 1810 [127] as a satisfactory connection with his own triangulation of 1803 [237], and Riddell had extended this to a station just inside Masulipatam District, north of the Kistna[4]. To close all this work Lambton measured a base-line near Guntūr. He then deputed De Penning to cover the country south of the Kistna with a network of triangles westward to the central arc, whilst he himself returned direct to Adoni before the rains of 1812. Lawrence was also employed at this time, and De Penning records a later visit to "one of Colonel Lambton's stations established in 1812, when Mr. Lawrence was employed in carrying the principal triangles across the Nulla Mulla Mountains"[5].

Lambton writes in September that De Penning

is now on the frontiers of Mysoor, having, with a large part of my heavy apparatus and establishment, taken a southerly route from the Coromandel Coast south of Nellore, so as to take in the Calastry and Gurrumcondah Districts[6], and connect Lieutenant Riddell's triangles of last year with my former positions in the Chittoor and Bomraje Pollams, and those on the northern skirts of the Mysoor Country.

The field operations to the northward have been attended with success beyond my most sanguine expectations ; the whole of the Guntoor, the Paulnaud, the Cummum, and Doopaud[7], and Kurnool Districts are completed, and an entire connection between Masulipatam, Gooty,

[1] NW. monsoon, May to September ; NE. monsoon, October to December. [2] From Masulipatam, 9–9–11 ; DDn. 63 (272) ; MMC. 1–10–11. [3] DDn. (56) ; MMC. 1–10–11. [4] TS. II (2). [5] separating Nellore from Kurnool, 57 M/NW. De Penning's Journal, 1–12–18 [247 n.4] [6] Kālahasti, 57 O/9 ; Gurramkonda, 57 K/9. [7] Cumbum, 57 M/2 ; Dūpādu, 57 M/5.

Ballary, and Adoni, is effected, together with an accurate sketch of the Kistna as far as the confluence of the Toomboodra. ...

When the rains are over, I propose sending a considerable part of my establishment through the western part of the Ceded Districts, the Harponelly[1], and the Soonda countries, so as to continue the triangular operations to the Malabar Coast. ...

As Lieutenant Garling has been employed in surveying the District of Goa [156–8], it may save some trouble if I could be supplied with his *principal* triangles, as I know that he possesses an instrument of a superior kind[2] [255].

Copies of Garling's triangles in Goa [158] were incorporated with De Penning's work, and connection was also made with Mackenzie's triangulation in Kanara [108].

De Penning reached Bellary in November after his long journey from the east coast, and after "a short time to arrange the vast mass of field work"[3], he set out again through the north-western districts of Mysore. The following extracts are taken from his interesting journal[4] ;

Wednesday, Dec. 30th. 1812. Bellary to Harrihaul[5]. ...

January 22nd 1813. Ascended very early this morning the high hill called Looguldarul, and arrived at the summit about 7 o'clock, and immediately set the people to work raising a platform, which was essentially necessary owing to the uneveness of the spot where the flag was fixed.

23rd. Employed this day and the last in observing angles.

Sunday, 24th. Early this morning employed in raising a mark as an object for reference, and after breakfast descended with instrument.

25th. Marched to Daursomdrum[6], a considerable village in the country of Mysore, ... about 10 miles nearly S. from Hirrihaul. ... On entering the Mysore frontiers at Surakul the country wears a different aspect, and is more delightful to the eye. ...

26th. Marched to Royedroog[7]. ... Ascended the hill with the instrument after breakfast, but the weather being dull descended at dusk, leaving the instrument on the hill, as we could not complete our observations.

27th. Ascended the hill early &, weather being more favorable this day, we completed our observations and descended, after packing the instrument.

28th. Employed in raising a stone pile for supporting a tree that was placed over the station for a mark, after which descended for breakfast at 12 o'clock. This job of raising a pile is generally the work of a couple of hours at most, but we met an unlucky accident. ... The pi e, after it was carried to its usual height & was on the point of being finished, gave way, & in an instant reduced to a confused mass ; but how great was my astonishment to find that not a single person was hurt by this catastrophe, which might have proved fatal to many of our followers were it not for the interposition of that Almighty and Most Merciful God, to whose goodness alone I can attribute this wonderful, or rather miraculous, escape of no less than 8 poor fellows from almost inevitable destruction.

The pile alluded to is a mass of great stones commencing in a circular base of 6 or 7 feet diameter, rising to the height of 9 or 10 feet, terminating in a point, and supporting a tree of 17 or 20 feet in length. It is always raised with loose stones that are found on the hill, and, as these are never found in any regular shape, the pile is sometimes a little distorted, in which cases if the stones be very bad the whole pile generally fails and becomes a rude mass, while those who are around must meet with some accident. ...

31st. Jerrymalli. Ascended the hill early this morning, but as the flags did not reach their destinations, I was obliged to leave the instrument on the hill, & descend at dusk.

Feb. 1st. As we were encamped in the midst of hills, we were visited by some peacocks early this morning, and desirous of returning the complaisance, I went out in search of my visitors, and after some difficulty persuaded upon one to return with me to the tents, where it was robbed of all its ornaments. ...

11th. Still in the Mysore, under the Amildar of Chittledroog[8]. ...

23rd. To Hoolycoontah, a small village in the Serah Talook, Mysoor. ...

March 11th, 1813. Early this morning ascended the hill Sheegakul with instrument & baggage. The country between Murmnaik & Shegakul woody & infested with Tygers. At six we returned to camp, where we were informed that a Cheater[9] had made a prey of an excellent bitch belonging to my friend Rossenrode [164]. ...

[1] Harpanahalli, 48 N/13. [2] Adoni, 19–9–12 ; MPC. 13–10–12. [3] DDn. 63 (299), 5–11–12. [4] MS. kindly lent by the De Penning family in Calcutta, 1937. [5] Hirahālu, 12 m. S. of Bellary. [6] Devasamundra, 57 B/13. [7] Rāyadrug, 57 B/14. [8] 57 C/13. Hulikunte, 57 B/12. [9] *cheetah*, or Indian hunting dog ; but in this case more probably a panther.

12th. Employed this day on the hill in watching for the flag. In the afternoon we discovered all our flags to our great satisfaction, and after getting a very good sett of a angles we descended at dusk after packing the instrument.

Disturbed about midnight by the dreadful prowlings of a royal Tyger, which appears to have been only a few yards from our tent. ...

Sunday 21st. This morning being foggy, I expected it would be pretty clear between 7 & 8 o'clock ; consequently I ascended the hill after an early breakfast. Sadly disappointed. The weather sultry & the evening very bad.

22nd. Early this morning ascended the hill again ; the weather still sultry & dull, but the flag I had expected to see to the W. being visible, I got as many angles as I could, and took the instrument down about an hour before sunsett, immediately after which all hands were sett to work about the pyramid, which was completed before dark. ...

This day I received orders from Major Lambton to return to Bellary, but as I was near one of my particular stations, from the summit of which I was desirous of viewing the country around, I halted at this village on the following day, & in the morning very early we ascended the hill.

De Penning now halted at Bellary till the end of the rains, Lambton reporting at the end of July ;

As soon as the weather is settled I shall dispatch a party to the westward for completing the survey of the Ceded Districts, and passing through a part of Bednoor, Canara, and Soonda, and terminating on the Malabar Coast, connecting the present with my former operations in 1805, which were then carried as far north as Koondapoor in the Canara country [240].

My intention was to have extended the survey through the Soonda to connect with the District of Goa, but I understand from Lieutenant Garling that he is now employed in making a detailed survey of Soonda [158–9], which will render it unnecessary for me to pass through that part, ... provided I can be furnished with his triangles [158,255][1].

In September 1813 Lawrence was sent out north and east from Bellary to fill in minor triangles towards Gooty and Adoni, whilst De Penning was to complete work up to the Tungabhadra on the west, and south-west through Sonda, without crossing into Marātha country. De Penning's journal continues;

10th. About 10 o'clock in the forenoon of this day I left Bellary with my wife, and arrived between 1 and 2 o'clock at Koodutinny[2], 15 miles W. of Bellary, near Lt.Colonel Dowse's camp [166]. ...

26th. Holal[3], In the afternoon I set the large instrument on the S.E. angle of the Fort. Holal is a large village about 2 miles East of the Toongabudra.

October 4th. Early this morning I took the large instrument with me, & rode to Harponelly[4], with the intention of taking a station on part of the Fort, and to return early for breakfast at Nichapoor. I arrived at Harponelly before daybreak, but had to wait till 9 o'clock before I could take any angle as the morning was foggy and the tops of the hills could not be seen. I returned to camp just at noon for breakfast[5].

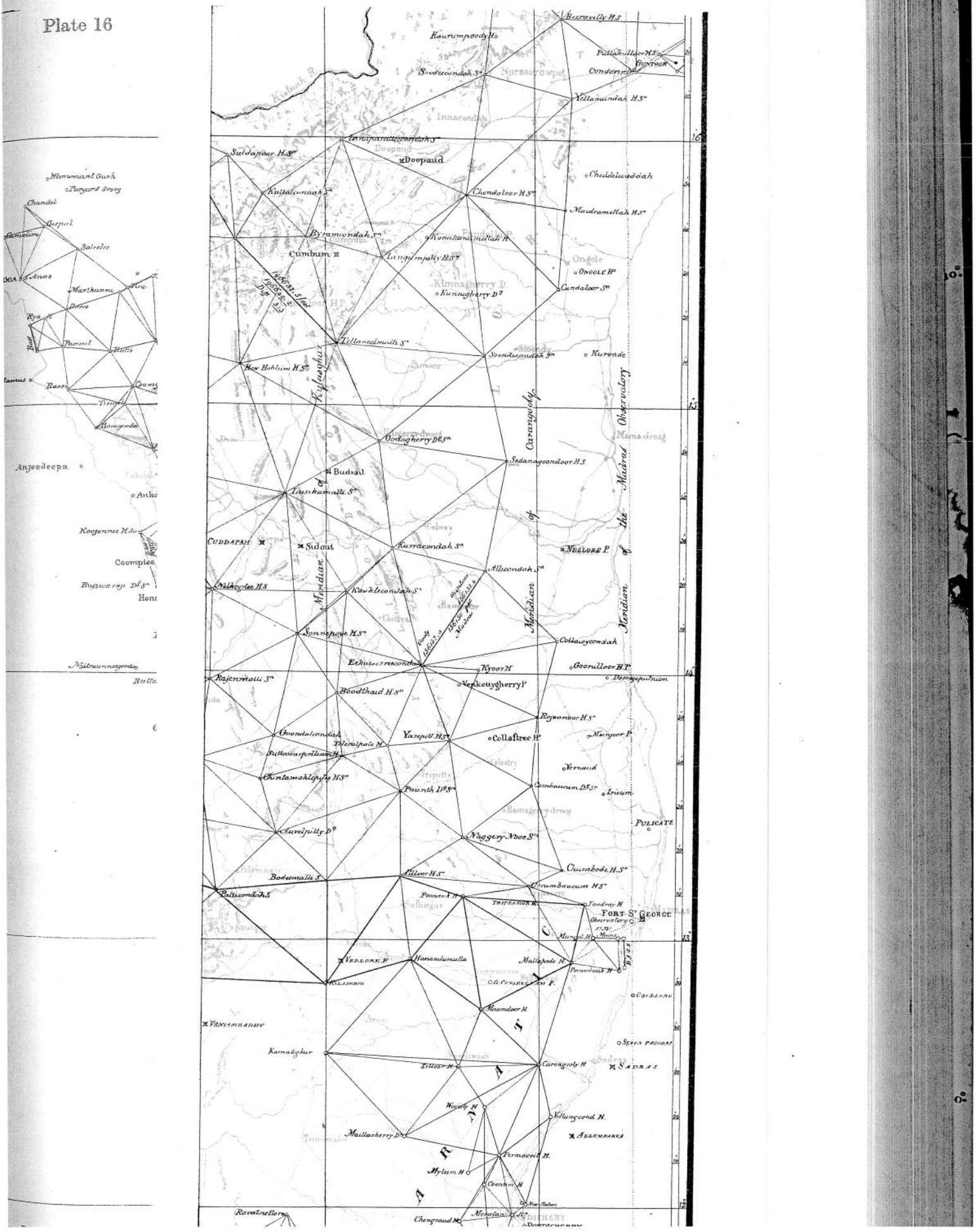
Working through Shikarpur and Bilgi he closed his triangles on the coast in the first week of January 1814 by measuring a base-line at Kumta, north of Honāvar[6]. He then rejoined Lambton at Adoni.

Meanwhile Lambton had visited Hyderābād to obtain permission to enter the Nizām's dominions, and to arrange for all the assistance he would require. The Resident, Henry Russell[7], reported to the Supreme Government that he had obtained the permission of the Nizam's Government for Major Lambton to enter His Highness's Territories. ... Major Lambton has himself been at Hyderabad to concert the necessary arrangements with me. He returned last month to Adony where he has left his instruments and followers, and will probably cross the Frontier with his whole Establishment before the end of the year.

Major Lambton has already brought his meridian line from Cape Comorin, on the 8th parallel, to Gooty, between the 15th and 16th. He intends to carry it in the first instance to Bider and hopes to be able to extend it ultimately to Nandavi on the Godavery, which is about the 19th parallel[8]. This...will make his arc the largest that has ever been measured, exceeding by near two degrees the celebrated measurement which was made a few years ago by the French Geometricians from Dunkirk to Barcelona[9] [202].

[1] DDn. 63 (317), 31–7–13. [2] Kudatini, 57 A/16. [3] Holalu, 48 N/9. [4] Harpanahalli, 48 N/13. [5] 48 J/15. [6] 48 J/7; Burrard (36). [7] (1783–1852); BCS. ; Resdt. Hyderābād 1808 and 1811–20. [8] Bīdar, 56 G/9. Nander, 56 E/8. [9] Mechain and Delambre, 1792–1801 Gore (151–3). DDn. 146 (1), 16–11–13.

Plate 16


Meridian of the Madras Observatory
Caravigoody
Kylaughur
Meridian
Meridian
Meridian
Doopaud
Cumbum
Onogole
Kunnugherry D.
Ramagherry drogg
Ramnaidroog
Anjeedeepa
Coomplee
Honc
Nalbanapoody
Bulle
CUDDAPAH
Sidout
Budvel
NELLORE P.
PULICATE
FORT St GEORGE
Observatory
VENIAMBADY
SADRAS
ARNAUT
CARNATIC
Kaurumpaudy Ho
Swadeconda S.
Yellamundah H.S.
Innapareddeconda S.
Suldapoor H.S.
Chelladiwaddah
Kullalconda S.
Chendaloor H.S.
Maudrametlah H.S.
Byramconda S.
Cumbum H
Lungumpilly H.S.
Onogole H.
Candaloor S.
Tillaneedmully S.
Soondrumdah S.
Kurvade
New Hahlum H.S.
Ordagherry D.S.
Sedanagoondoor H.S
Trunkamally S.
Kurracondah S.
Allisondah S.
Nellacoylee H.S.
Kawlreconda S.
Sonnapoye H.S.
Collaveyconda
Ethalacherreconda
Kyoor H
Goorulloor H.
Kajenmally S.
Boodthaul H.S.
Venkettygherry
Reyanoor H.S.
Owendalconda
Yarapeu H.S.
Collastree H.
Manpoor P.
Tiloraipate H.
Vernaud
Comhoucum D.S.
Irieum
Pounth D.S.
Nuvelpilly D.
Naggery Woos S.
Cumbodee H.S.
Bodenally S.
Pillaur H.S.
Pallicondah S.
Poonamallee H.
Vandray H
Mallapode H.
Perumbaukum H.
Mundoor H
Seves Pagoda
Karnatghur
Tellaur H.
Carongoly H
Yellungoond H.
Allemparva
Vermaceid H.
Mylum H
Chengcaud H.
Monrolan
Pondicherry
Rovatnellore

Lambton describes his extension of the arc to Bīdar;

In the latter end of 1813 and beginning of 1814 the great meridional triangles were carried from Adoni, in the Ceded Districts, as far North as Kotakodangul[1] in latitude 17° 8′. From thence a branch of principal triangles was extended easterly to Hyderabad and Secunderabad. Those from Adoni to Kotakodangal formed the western part of the belt. This belt extended easterly so as to take in Kurnool, and thence northerly to Hyderabad[2].

This was done early in the season, but, as much indoor work was required, all hands were employed...in finishing a vast number of computations. ...

After that [October 1814], the meridional triangles were resumed, and commenced at Kotakodangul; from thence they were extended to Daumergidda in Latitude 18° 4′ nearly. Near this [at Bidar] the ground was found to answer for a Base line, which was commenced on the 23rd January, and completed the 13th February 1815. Daumergidda being found a convenient station for observation of the stars, the Zenith Distances were begun on the 31st January, and finished the 5th March 1815; soon after that the whole party returned to Hyderabad[3].

He now settled himself at Hyderābād to work up computations and reports[4] and analyse results to his satisfaction. He was asked "the probable time in which this survey may be completed", but would not commit himself;

At present I am employed in preparing my Report of the Survey of that part of the Peninsula lying between the latitude of 14° and the southern boundaries of the Nizam's and Mahratta Dominions, which I should have had ready before this time, had I not been anxious to extend the Meridional series of triangles as far north as 18°. ... This work, which employs all hands, will prevent my sending out any party till after the rains in 1816. ...

The whole Peninsula is now completed, from Goa on the west to the mouths of the Kistna on the East, with all the interior. This comprehends a vast extent of Country and, if I live to finish what I have proposed, ... a foundation will be laid for carrying this survey over the Deckan, through Orissa and the more northern provinces, and through the Mahratta Dominions, should future circumstances ever render it practicable; but the time to accomplish these objects must remain indefinite[5].

[1] Kodangal (Korangal), 56 G/12. [2] By Lambton himself, *v.* De Penning's Journal 9–2–18; see also TS. V (2). [3] reaching Hyderābād by 1–4–15; DDn. 144 (195). [4] Report submitted 1818; MRIO. 145 (21). *Plan...of Trigonometrical Operations.* ... 1811–14. 8 m. to an inch. 8 m. chart, Ben. Regr. 584 (12); 48 m. sketch of triangles, ib. 586 (12); [5] Hyderābād, 24–6–15; MMC. 8–7–15.

CHAPTER XVIII

LAMBTON'S PROFESSIONAL DETAILS

Mathematical Principles — Instruments — Base-Lines — Triangulation — Geodetic Results — Computation & Records — Appreciations.

THE essential features of Lambton's proposals were that his survey should be based upon "correct mathematical principles"—that it should extend right across the Peninsula—that it should be capable of extension in every direction—that it should form a reliable basis for all other surveys—and that it should at the same time

accomplish a desideratum still more sublime, viz., to determine by actual measurement the magnitude and figure of the earth, an object of the utmost importance in the higher branches of mechanics and physical astronomy[1].

Though Lambton is said to have studied mathematics under the famous professor Charles Hutton [I, 248, 316], and to have met the even more famous William Emerson,

his education was known to be chiefly his own work ; nor was he ever heard to acknowledge himself indebted to any teacher for what he had acquired[2].

He had read deeply while stationed in America, taking a special interest in geodesy, and following closely the work of General Roy and of the Ordnance Survey of Great Britain. He had published papers on statics and applied mechanics[3]. In the *Plan* of his survey[4] he discussed in detail the special precautions that would be necessary to ensure these "correct mathematical principles" [234] ;

It has been the usual practice...to work upon a series of plane triangles, ... thinking the curvature of the Earth of too of little consequence to be taken into consideration ; and the only mode of correcting was by observing Jupiter's satellites, occultations of stars, &c., for determining the longitude. ... It is easy to see the errors that must result from extending a survey over a portion of the globe comprehending a number of degrees both in Latitude and Longitude. ... Correction by astronomical observation, ... defining progressively the position of objects not more than fifteen or twenty miles asunder, ... is by no means sufficient. ...

The first operation for obtaining a *datum*...is by the measurement of a *base line*, which being reduced to the level becomes a part of a great circle on the surface of the Earth. ... From thence is derived new data to proceed in all directions, recollecting that...the observed... angle is to be corrected again to the angle made by the chords.

But, as the figure of the earth is known to deviate considerably from a sphere, ... it becomes necessary...to determine the measure of a degree upon each of these great circles. ... Having obtained the length of a degree upon the meridian and its perpendicular in any given latitude, they will serve as data for computing the Latitude and Longitude of places near that parallel, and near to that, or a *known*, meridian. ...

It has been discovered from experiments made by pendulum observations in different Latitudes that gravity at 10° from the equator suddenly diminishes. If so, ... a degree on the meridian from that parallel to the equator must be very short compared with a degree immediately to the northward of 10°. It will not only be necessary to attend to this circumstance in the course of a mathematical survey as needing a correction, but as an object leading to something curious with regard to the figure of the earth. ...

There has yet been no theory sufficiently perfect...with respect to the precession of the equinoxes. For most...assumptions have been that...the equatorial is to the polar diameter as 231 to 230 ; for by allowing any other ratio the results will make the effects of precession different from what they are observed to be ; and yet the measurements which have been made

[1] Closing words of Memoir of 1801 ; DDn. 61, 10–3–02 ; BPC. 3–3–03 (4). [2] Warren (74). [3] eg. *As R.* VI, 1799 (93–101 ; 137–61). [4] Burrard. (3–6) ; DDn. 63 (1, *et seq*), 10–2–1800.

on the meridian in different latitudes give the protuberance at the equator 1 : 312 instead of 1 : 230. ... But these measurements have not been made nearer the equator than 33° 18′ of Latitude. ... I shall rejoice indeed if it should come within my province to make observations tending to elucidate so sublime a subject.

In another paper he writes with acumen ;

Should the earth prove to be neither an ellipsoid, nor a figure generated by any particular curve of known properties, but a figure whose meridional section is bounded by no law of curvature, then we can obtain nothing until we have an actual measurement[1].

Copies of his *Plan* and of Mackenzie's *Plan of the Mysore Survey* [91] were passed to Rennell in London, and the great geographer so entirely misunderstood Lambton's proposals that it is difficult to think that he could have read them through [119–20]. He was possibly misled by the Government order appointing Lambton to charge of an " Astronomical Survey " [116, 234], and also by Mackenzie's suggestion that, for his survey of Mysore, the " principal points ought ...to be corrected by *Astronomical* observations connected by a series of triangles " [92].

However it was, Rennell gained the idea that whilst Mackenzie carried out a topographical survey of Mysore, Lambton was to conduct a completely independent series of *astronomical observations*, on which Mackenzie's survey should be subsequently adjusted, which he naturally describes as " one of the most extraordinary things that has been heard of "[2]. Copies of his letter of protest were sent to Lambton and Mackenzie [120]. Lambton was much disturbed, and was at pains to write a full and detailed refutation[3] of these criticisms, which Rennell eventually withdrew [I, 376 ; II, 264].

LAMBTON'S INSTRUMENTS

Before telling of Lambton's methods and results, it would be well to describe his instruments.

For his work in Mysore during 1800–2, he had instruments purchased from Dr. Dinwiddie in Calcutta [3, 233], which included a zenith sector, a 16-inch transit, and a steel chain. Dr. Dinwiddie, a lecturer in science, had accompanied Lord Macartney's[4] embassy to China which sailed from Portsmouth in September 1792. The embassy took a large collection of unusual and valuable articles intended as presents. It was thought that,

Astronomy being a science peculiarly esteemed in China, and deemed worthy of the attention and occupation of the Government [I, 149], the latest and most improved instruments for assisting its operations, as well as the most perfect imitation that had as yet been made of the celestial movements[5], could scarcely fail of being acceptable[6].

[Dinwiddie was] expected to instruct the Chinese in electricity and in flying balloons, ... but it all ended in smoke. ... The Chinese are certainly far behind the European world. They have but a very limited knowledge of mathematics and astronomy, although from some of the printed accounts...one might be led to imagine that they were well versed in them.

The valuable instruments not being appreciated were all brought back and passed over to Dinwiddie as part payment for his services, and

on our return he requested to be discharged and sent to Calcutta, where he meant to deliver lectures. The novelty took, and Dinwiddie is said to have made a little fortune[7].

Lambton had met him in Calcutta before sailing for Madras in 1798, and as soon as his survey was approved arranged for the purchase of the instruments. After they had been passed by a small committee Dinwiddie wrote to the Bengal Government;

The Government of Fort St. George has purchased of me the following instruments intended for a Spherical Survey of the Peninsula. ... Ramsden's last improved Zenith Sector [I, 166], his spirit level, and surveying chain, the same as received by General Roy, with a new Astronomical Tent, Chronometer, sextant, and a few other articles of less worth.

[1] *As R.* VII, 1801 (318). [2] DDn. 68 (53). [3] DDn. 63 (68), 17–3–02. [4] Governor of Madras, 1780-5 [I, 166]. [5] orrery [I, 204]. [6] Stanton, I (43). [7] Robbins (181, 409).

I was desired by Captain Lambton to show the instruments to Mr. William Hunter [I, 340] and Captain Sydenham[1], and on their approving of them, to deliver them well packed to Captain Sydenham, who would forward them by the first safe opportunity to Madras. Captain Lambton also informed me that the Government of Fort St. George would...procure pay in Calcutta of 3700 Sicca Rupees, the sum agreed on as the price.

Captain Sydenham having been prevented by indisposition from taking charge of or even looking at the instruments, I have shewn them to Mr. Hunter, Captains Colebrooke, Humphrys and Blunt. ... Captain Humphrys, in particular, has examined them with much attention, and he is a good judge of such instruments [I, 340]. ...

The whole Apparatus will be packed in five large cases in which to be conveyed to Madras at the expence and risk of the purchaser. ... Captain Lambton is impatient to enter on his Survey which he cannot possibly commence before the arrival of the Instruments, the Chain being necessary for the measurement of a base, which is his first operation[2].

A sum of Rs. 3,600 was paid to Dinwiddie on 20th March and the bill of lading despatched to Madras on 7th April[3]. Lambton found the instruments "in a wretched state. The telescope of the zenith sector was so rusted that it was impossible to move the tubes for the adjustment of the focus[4]". It was not long, however, before he had them all in good working order.

The ZENITH SECTOR was built by Ramsden, and was perhaps one of the instruments ordered by the Directors for use by Burrow or Topping [I, 166; II, 236-7].

The radius of the arc is five feet, and the arc itself extends to nine degrees on each side of the Zenith. It is divided into degrees and smaller divisions of 20′, each of which is numbered. Each of these last is again sub-divided into four of 5′ each. The micrometer...is graduated to seconds, ... but the scale being large a small fraction of a second can be easily defined. ... All the astronomical observations for latitude by Major Lambton were taken with this Zenith Sector[5].

It is contained in two large boxes, seven feet and upwards in length; the body of the instrument being in one box and the frame in another. It requires to be carried by Coolies, 14[6].

Everest writes of it in 1830;

It would not now, perhaps, be considered a very perfect instrument, but, previous to the construction of that used by the late General Mudge[7], it was, I believe, thought the best of the kind that had ever been designed for field operations[8].

It was used by Lambton in January 1801 for observing latitude at his first base-line at Bangalore; it was last used by Everest at Kaliānpur in 1825 when he wrote;

This beautiful Instrument has been less subject to the effects of climate than the Great Theodolite, and its framework is almost as entire as when it first came from Mr. Ramsden's hands; but in consequence of frequent use the principal micrometer screw has been much worn and acts unequally. The object glass of the Tube has also received some injury, which...I attribute to the too profuse distribution of spirits of wine, some of which...has insinuated itself between the lenses, and there left an obscure spot, which materially affects its clearness[9].

In 1881, being found in the Mathematical Instrument Department in Calcutta in a disintegrated condition, with some of its parts missing, it was set up and photographed[10]. In 1916 it was presented, with other instruments, to the Victoria Memorial in Calcutta[11], where they have, since 1937, been exhibited in a special show-case.

The OBSERVATORY TENT was nine feet square, specially constructed for the sector, and regularly used by Lambton[12]. Everest however did not trust to a tent, which "appears to me far too hazardous an exposure; and accordingly I constructed a temporary observatory of stone and mud"[13].

The CIRCULAR TRANSIT INSTRUMENT, for taking horizontal angles, was made by Mr. Troughton [191 n. 2]; ... horizontal limb is only eight inches *radius*, without a micrometer, ... graduated to 10″, and though it is an excellent instrument, correct and easy

[1] Probably Thomas Sydenham, before appt. to Hyderābād [I, 387]. [2] from Dinwiddie, 3–2–00; BPC. 14–3–00 (138). [3] ib. 20–3–00 (27). [4] *Cal. Rev.* IV, 1845 (79); incomplete accounts of the purchase are given by Geo. Everest (50) and Thomas Jervis (14–5). [5] SGO. note of 1916; see also *GTS.* XI (15). [6] DDn. 63 (63), 17–3–02. [7] Wm. Mudge (1762–1820), RA.; Ordnance Survey. [8] Geo. Everest (53). [9] DDn. 171 (332), 2–3–25. [10] *GTS.* XI (15–8) pl. I. [11] MIO. 2687/3–3962; 6–7–1916. [12] DDn. 63 (63), 17–3–02. [13] Geo. Everest (54).

in its adjustments, yet its powers are not sufficient for taking horizontal angles where they are to be reduced to the angles made by the chords[1].

It is carried on its frame in a box in the manner of a Sedan chair. It is a full load for four coolies, but for the purpose of expedition in climbing hills I have always allowed six[2].

This was the instrument used by Lambton in 1801, and by Warren between 1802 and 1805[3]. Lambton did not think it good enough for his primary work, and borrowed a better instrument from the observatory to supplement the great theodolite [255].

The CHAIN is now preserved in the Survey museum at Dehra Dun. It is of blistered steel, constructed by Mr. Ramsden [I, 165], and is precisely alike, in every respect, with that used by General Roy [I, 164] in measuring his base of verification on Romney Marsh [1787]. It consists of 40 links of 2½ feet each, measuring, in the whole, 100 feet. It has two brass register heads, with a scale of six inches to each[4].

As soon as possible, he [Lambton] got a new chain from England, and this he very wisely never allowed to be taken to the field at all, but reserved as a test. ... Dr. Dinwiddie's chain, which was used in the field, seems to have been an excellent one; it was constantly used with what we may almost be permitted to call religious care[5].

The instruments ordered from England in 1800 [234] reached Madras during 1802, and consisted of the Great Theodolite, a second steel chain, an 18-inch repeating theodolite, a 3-foot brass scale, and several smaller theodolites. Goldingham was not sure in 1823 whether Lambton had included the cost of them in his accounts. I...think that he sent for the large Instrument himself, as the quickest mode of getting it out. I saw this Instrument when it arrived and was first put up; and I think it likely that he charged the cost of it, as well as others he might have got out in the same way, in his public accounts[6].

All the instruments were charged to Government, and in 1812 Lambton submitted "a return of the public instruments" then in his possession, including,

1 Large three-feet Theodolite for carrying on the Principal triangles.
1 Circular Instrument for the 2nd class of secondary triangles.
1 Zenith Sector for observing the fixed stars.
1 Small transit telescope—2 Steel chains—1 Boning telescope, and 6 thermometers—for the base-lines.
1 Standard Brass Scale—2 Setts of Beam Compasses—1 Astronomical telescope—2 Small chronometers[7].

The GREAT THEODOLITE had been already constructed when Lambton's order went home, and in writing of the one bought from Ramsden for the Ordnance Survey in 1791 [I, 166], Everest records that the Court speedily had a fac-simile of this very instrument made by Cary, ... which...was taken in its passage to India by the *Piémontaise* French frigate, landed at the Mauritius, ... and gallantly forwarded on to its destination...with a complimentary letter to the Government of Madras[8].

Lambton had expected it early in 1802, and told Government that it was for taking the horizontal angles in the principal series of Triangles, where the three angles are taken and corrected for the angles made by the chords. This Instrument is daily expected, and, compared with the Circular Instrument whose diameter is only 16 inches, I should think it would require at least 12 coolies[9].

He valued it at £ 650, and when packed for transport it weighed 1011 lbs. The azimuth circle was 36 inches in diameter, and the vertical circle 18 inches; each was read by two microscopes. Everest records that it "was originally a very noble piece of workmanship, and seems to have been divided with great accuracy", but that by the time he came to use it after Lambton's death it had become very shaky, and its accuracy was undoubtedly much affected by the accident of 1808 [241, 254][10]. It was afterwards re-conditioned by Barrow, and continued in use till 1866. It now stands in the museum at Dehra Dūn.

The second steel CHAIN was made by Worthington and Allen after Ramsden's

[1] *As R.* VII, 1801, 320. [2] DDn. 63 (63), 17–3–02. [3] MMC. 21–6–11. [4] *As R.* VII, 1801, 321 [5] *Cal. Rev.*, IV (84). [6] DDn. 91 (389), 13–5–23. [7] ib. (346), 2–8–12. [8] Geo. Everest (45–6); Everest (21). [9] DDn. 63 (63), 17–3–02. [10] Geo. Everest (45–7).

patent[1], and was kept both by Lambton and Everest as a standard [256].

The 3-foot brass scale "laid off by Cary from the scale of Alexander Aubert Esq."[2], was used by Lambton as a standard of comparison for both chains[3] [257].

Besides these *public* instruments, Lambton had a number of others purchased at his own cost " of the most valuable kind, improved from my own suggestion, and adapted both to Astronomical and Trigonometrical purposes. These I will readily lend to the Publick service "[4]. He asked later for an increase of establishment for their carriage. " The principal are; 1st. A repeating Circle of 18 Inches diameter for taking horizontal angles, with a vertical circle of the same diameter. 2nd. Astronomical Clock "[5].

Of this repeating circle Everest records that

the splendid large theodolite by Carey, which is the property of the Hon'ble Company, was always ill calculated for secondary triangles—for principal Triangles it was probably without a rival in the world until the year 1808, when in drawing it to the top of a Pagoda in Tanjore the side-rope gave way, and the limb received a blow against the building which threatened to render it for ever useless [241].

The high mind of the late Superintendent could not brook the idea of being reproached for this accident, the blame of which he took to himself, and he immediately, unknown to Government, wrote to Carey to make a circular instrument which should answer both for the purpose of principal and Secondary Triangles. ...

The large Theodolite was at the end of 6 months restored...in a manner surpassing his most sanguine expectation, ... but the circumstances of the case were never, I believe, officially brought to the notice of Government, and the late Superintendent preferred sustaining the whole charge of the new instrument to bringing his high name at all into question[6].

The cost of this new instrument landed in India came to £ 230. It was originally used from a tripod, but some years later Lambton had a brass platform made for it at Government expense[7]. At his death the instrument was bought for the Nāgpur survey and in 1831 it was restored at Everest's request;

This instrument during the life-time of the late Lt. Colonel was highly precious to me and the rest of my department, and it was a source of great grief to me that...no opportunity was left to me of purchasing it on account of Government.

It was sold, I think, for either 400 or 500 Nagpore Rupees, and Mr. Jenkins [52] wrote to me requesting my acceptance of it, ... but he was afterwards induced to modify this liberal offer, in consequence of a declaration from the late Captain Stewart [132, 320]. ... I am naturally anxious to recover possession...because it is an old friend and fellow traveller which has gone over many a league of land with me, and stood me in good service[8].

In giving further particulars he writes;

The instrument...cost 525 Nagpore Rupees. The body of it consisted of a brass frame, with (I think) 6 small pillars, above which was a Horizontal Circle with two microscopes.

The Horizontal Circle was...18 inches in diameter, in the middle of which was a brass plate. ... Upon this brass plate were fixed two brass columns, with an apparatus attached to each for supporting the arms of the Telescope.

This Telescope was...about 22 or 24 inches long, and it had a small semi-circle at one side of it. The Telescope might be taken off and on at pleasure, and when the instrument was required for astronomical purposes, it was replaced by another Telescope fixed between two circular plates (called a vertical circle), the diameter of which was also, I think, about 18 inches. ...

The Instrument, when used, stood upon a mahogany tripod. The proper designation for it is a Repeating Altitude and Azimuth Instrument; it may also be called a Repeating Theodolite, because, by disengaging the end of the lever, the Telescope and its supporting pillars may be made to revolve independently of the horizontal circle, and by fixing the end of the lever again, the Telescope with its pillars move together with the Horizontal Circle; to accomplish which the horizontal circle has a double axis, one within the other[9].

The instrument was repurchased and after renovation was employed for several years on primary triangulation.

[1] Sent out by Berge; originally laid off from Ramsden's bar, Burrard (48). [2] FRS. 1772; *DNB*. [3] Geo. Everest (51); Kater, *Phil Trans*. 1821. [4] DDn. 63 (251), 28–1–11. [5] DDn. 92 (102). 28–10–19. [6] DDn. 198 (109), 18–8–23. [7] DDn. 171 (219), 2–7–24. [8] DDn. 266 (90½), 4–6–31. [9] DDn. (105), 5–9–31.

Two other theodolites are worthy of mention, one described by Goldingham;

When Colonel Lambton was first appointed to the Trigonometrical survey, he had no Instrument wherewith to commence his operations, and I obtained permission from Government to lend him a circular Instrument of smaller power than that alluded to by Captain Everest [just described above], but better adapted for vertical observations [253]; this Instrument Colonel Lambton returned not long before his death; it appears to have been much used, and I am having it fitted up again, when, if uninjured in its movements, it will answer our purpose full as well, if not better, than the larger Instrument[1].

It was then, at Everest's special request, returned to the Great Trigonometrical Survey, and used on secondary and minor triangulation.

Garling's private theodolite, which was referred to with great respect, was used by him on the east coast as well as in Goa and Sonda on triangulation which Lambton thought good enough to embody with his own work [158, 247]. Everest records that is was

constructed after the model of the large theodolite; the cost...I understand was £ 130; in this the repeating powers were wanting, which was a serious defect; it had no vertical circle, and there was an additional telescope underneath the limb, which in my humble estimation is altogether superfluous[2].

It was 18 inches in diameter, and made by Cary on the model of that made for Lambton. The horizontal limb was divided to 15 minutes, and read by two micrometers to 2 seconds. It had a vertical semi-circle of 9 inches diameter, graduated to 15 minutes and read by micrometer to 5 seconds[3].

BASE-LINES

The following base-lines were measured between 1800 and 1815[4], all by Lambton except that at Bangalore measured by Warren in 1804, and that at Kumta measured by De Penning.

Year		Place	Length in miles	Time taken Days
Oct. to Dec.	1800	Bangalore, near Krishnarajpur, 7m to E.	7.44	57
April; May	1802	St. Thomas' Mount, near racecourse	7.58	42
May to July	1804	Bangalore, near Mantapum to NE.	7.19	49
March–April	1806	Coimbatore, near Pachapālaiyum 40 m. to E.	6.12	30
July	1808	Tanjore, near Vellum, to SW.	4.11	4
Feb.–March	1809	Pālamcottah, N. of Tinnevelly.	5.78	19
April–May	1811	Gooty, 3 m. to W.	6.17	22
before April	1812	Guntūr, 4 m. to E,	5.00	5
Dec. 1813–Jan.	1814	Kumta, Lat. 14° 27′, West Coast	4.092	7
Jan.–Feb.	1815	Bīdar	5.834	22

The line at Bangalore, measured between 14th October and 10th December 1800, was the start of Lambton's field operations.

A series of pickets and tripods, with large wooden heads, was lined out to support five wooden coffers, each twenty-foot long, which were evenly levelled by elevating screws in the tripod heads; alignment was made, and slopes observed, with the 16-inch transit instrument [252-3].

The coffers, built up of planks, were from 3 to 6 inches deep, the sides projecting two inches below the bottom to give rigidity and fit over the picket heads. The chain, placed in the coffers, had the rear end fastened to a stout post, and was stretched by a weight at the front end. Measurement was then made from the register scales at both ends.

Owing to the shortage of planks there were no spare coffers, and when the single set was moved forward twenty men, one to every two links, lifted out the chain,

[1] DDn. 91 (339), 13–5–23. [2] DDn. 171 (219), 9–7–24. [3] Journal, MRIO. M 63. [4] *GTS.* I (37–44).

laid it on the ground, then carried it forward, and replaced it in the coffers. All this was done with the greatest care and by word of command, so as to cause as little wear to the chain as possible; there was no second chain for check.

At each measure a thermometer was put into each coffer, and left for some minutes covered by a cloth, and the mean temperature of all five then recorded[1].

The approximate height of the base above the sea level was determined against corresponding barometrical observations made at Madras[2].

In his report to Government Lambton writes;

I have finished my measurement of a Base Line...on the 10th instant. ... I have met with some small impediments owing to the season and the rains, which consequently obliged me to make breaks in the line. But in these places very particular care was taken to complete the distance, and I have reason to hope that no error exceeding eight or ten inches will arise. ... I have directed a small mass of stone masonry to be erected at each extremity, in the centres of which are preserved the points of commencement and termination of the Base. ...

The operations have taken up very considerable time, but, being a foundation for a work of great extent, ... the sacrifice of a few weeks would bear no comparison with the advantage of an accurate measurement[3].

In a letter to Close he writes even more clearly, "You will see that the rains have caused some impediments"[4] [234], which disposes of a fantastic story told by Everest many years later that

the break in its length was solely caused by the action of the natives who, in the course of the measurement, had set to work and deliberately excavated a series of large tanks in the actual alignment[5].

Government pressed that accuracy should be above suspicion, even at the cost of remeasurement[6] to which Lambton fully agreed;

It is of the utmost importance to have the fundamental principles of this survey established on the most unexceptional basis. And, as the measurement made near Bangalore is well situated to become a base of verification to the triangles crossing the Peninsula, as well as a foundation for extending the operations northerly, I had always the intention of measuring those breaks which appear on the plan, and I think when the season is favourable the whole had better be examined, and the chain run from one extremity to another so that, in case there should have been any error in counting the chains, it may be detected.

In the great space from the Coromandel to the Malabar Coast, there ought to be at least three more measurements made, one on the coast near Madras, one somewhere near Vellore, and another towards the Malabar Coast; perhaps on the sea-beach would be best, as I am informed a straight line may be drawn on that beach to an extent of several miles without interruption.

Upon these several bases the series of principal triangles should be continued and computed with the greatest mathematical precision, as they will be the foundation for every other series that may hereafter be extended northerly and southerly[7].

As already noted, none of this early work was embodied in the records, and a fresh base at Bangalore was measured in 1804 [3, 239].

Early in 1802 Lambton made a fresh start near Madras and measured a base-line that would serve both for a degree along the meridian and for his triangles across the peninsula [3, 237]. He chose a site just to the east of St. Thomas' Mount. For the measurement, which was begun on 10th April and completed on 22nd May, he now had the use of the new chain just received from England which he kept as a standard, making comparisons with the working chain before and after measurement. Various improvements of detail were introduced, and as a further precaution Warren was deputed the following year to make an independent measure, without coffers,

partly to see whether any errors have been committed in numbering the chains in the former one, and partly to know how far a line measured on the surface of very level ground will differ from the truth[8].

The height of the north end of the base above sea level was obtained by reciprocal vertical observations between the beach and the top of the race-stand, four miles

[1] TS. I (37) records variations of length due to temperature. [2] Lambton's account; *As R.* VII, 1801, (320 *et seq*). [3] DDn. 63 (19), 22-12-00. [4] ib. (20), 23-12-00. [5] *GTS.* XIV, *H* (v). [6] DDn. 62 (15) & 64 (36), 24-9-01. [7] DDn. 63 (49), 18-10-01. [8] ib. (84), 20-5-03.

apart, and short lines of level were run from the beach to the low-water line, and from the race-stand to the extremity of the base[1]. Lambton reported that the work had been conducted with with every possible attention, and with an apparatus fitted to ensure as much correctness as the nature of any mechanical process will admit of, ... I may venture to consider it as perfect a thing of the kind as has yet been executed[2].

Experience with his new instruments led Lambton to reject his first work in Mysore [236], and in 1804 Warren measured a new base on a more favourable site, completing it between 26th May and 11th July in the same manner as that at St. Thomas' Mount, except that undulations had to be observed and reduced to the horizontal. According to Lambton's calculations the measured length differed by only 3·7 inches from that brought up from Madras by triangulation[3].

The original intention of measuring a base on the Malabar Coast was abandoned [256], and the next one to be measured was at Pachapālaiyam, on the meridional arc, about 135 miles south of Bangalore. This was completed in 1806, between 20th March and 19th April, and its measured length differed by only 7·6 inches from that computed from Bangalore. The height of the south end as derived from the triangulation was 926 feet above sea level[4].

The measurement at Tanjore being made along the ground without coffers, took only four days, and Lambton writes ;

I have never yet been able to compare this mode of measuring with that made in the coffers, but I am fully persuaded that there cannot be any sensible difference. The most delicate part of it is in keeping the chain steady at the following end, while the mark is brought to the arrow of the leading end, but a very little experience will teach the persons at the capstans to yield to each other, and remain firm as long as they like. ... On the sea-beach it often answers extremely well[5].

By the regular comparisons made between the two chains, it was found that the measuring chain steadily gained in length over the standard until the measurement at Gooty in 1811, when the excess was found to be less than at Pālamcottah two years before. This led Lambton to suspect that the standard might not be so invariable as he had assumed[6], and at Bellary in 1813 he made the following test against the three-foot brass scale [254].

A low brick wall was built, the top surface carefully levelled and coated with fine plaster. Into this surface was built a series of polished brass studs, the first five at $2\frac{1}{2}$ feet, and the remainder at 10 feet, apart. A length of $2\frac{1}{2}$ feet was then taken from the scale with a beam compass, and transferred to the first five studs to give a length of 10 feet ; this ten-foot length was then transferred to the remaining studs in succession by means of a special beam compass, till the full 100 feet had been laid down.

Tents were pitched over the full length of the wall, and the standard chain and its thermometers laid out in their shade, and as soon as the 100 feet had been laid off the chain was stretched along the top with one end firmly fixed and the other carrying the weight and stretching apparatus. The chain was found 0·034 inch longer than the length marked on the wall, and from this Lambton deduced a factor of correction. Similar comparisons were made at Hyderābād the following year[7].

The base-line at Bīdar was measured in 1815 between 23rd January and 13th February, Lambton charging 44 *pagodas* for

a new set of Machinery for adjusting the Coffers, ... consisting of eleven new tripods, with each a Male and Female screw, and Iron panales [handles ? ?], constructed for elevating and depressing, and finished in a most complete and improved manner[8].

Lambton's work was not superseded until after 1865, by which time, precise standards of length had been introduced, giving a trustworthy unit of measure, such as did not exist in Lambton's day [267].

[1] *As R.* VIII (137–93). [2] DDn. 63 (76), 26–6–02. [3] *As R.* X, 1808 (306–8). [4] Burrard (24). [5] ib. (28). Everest (132) states that it had been allowed to become rusty and had lost length in the cleaning. [6] DDn. 286 (276), 30–8–36. [7] Burrard (3–9). [8] DDn. 62 (333), 1–2–14.

TRIANGULATION

It has already been emphasized that the first object of Lambton's survey was to provide an extensive and reliable basis for all other surveys. Whilst the determination of the length of a degree, both along the meridian and along its perpendicular, was essential to the computation of geographical positions [250], the deduction of refined geodetic values for the figure of the earth was a secondary consideration.

The following was the plan which Lambton followed for his triangulation across the peninsula ;

With respect to the manner and direction of the future triangles, since they are intended to establish a series of primary and fundamental points, ... the most likely means of avoiding errors will be to extend this series of points as nearly in the direction of the same parallel of latitude as circumstances will admit, or in the direction of some meridian. ...

I should extend the first series of points, beginning on the Coromandel coast near the latitude of 13°, partly on account of the Base having already been measured nearly in that parallel in the neighbourhood of Bangalore ; and partly because...I know the country to be favourable to the purpose. ...

After having crossed the Peninsula, I would then commence again from the Base near Bangalore, on account of its being nearly half the way from sea to sea, and proceed as nearly north as circumstances would admit, ... continuing the principal triangles as far as the Kistna or Toomboodra. ... From the same base another series might be extended to a certain distance southerly, at least as far as where the Eastern Ghauts meet the range of mountains running from Shevagunga and Sevendroog. ...

When these series of triangles are completed, it would then be a matter of indifference in what direction others were made to branch out. Whatever object might be most desirable... could now be accomplished with little risk, and upon these points a general survey of the Peninsula...might then be carried on, upon certain and infallible grounds[1].

Although he eventually covered the south peninsula with a continuous network of triangles, these were not all of one class or without design. The principal triangles were carefully laid out in meridional or longitudinal chains, observed with the 36-inch theodolite, and computed independently of the secondary network. From the first the secondary work[2], was to be the particular task of his assistant whilst Lambton devoted himself to the primary triangles ;

As I am in daily expectation of my apparatus from England, which, with the instruments already in my possession, will...enable more persons than one to be employed at the same time, ... I...suggest...that were an assistant attached to me, who could be carrying on a series of smaller, or secondary, Triangles, while I am attending to the Principal ones, both the time and expenses attending this survey would be considerably diminished. ...

The principal series...will have to be determined with great accuracy, and one particular Instrument will be used for *that* purpose, and...if another person...by taking up those points, could carry on a series of triangles requiring only the ordinary computation, and an Instrument of inferior powers, [he] would be the means of at least doubling the progress of the work, either by extending it...or by filling up more minutely the extent of country in the intervals[3].

The first operation after the measurement of a base-line was to determine the azimuth of the base by astronomical observations of *Polaris* at each end. A series of small triangles was then necessary to connect with a side of the principal triangles. At selected stations latitude observations were made with the zenith sector, those at the extreme stations being made to the same set of stars [260].

All three angles of the principal triangles were measured three or four times each, without change of zero ; spherical excess was computed from Dr. Maskelyne's[4] formula. Observations were made to flags or opaque signals, and had often to be repeated on account of hazy weather : triangular errors were distributed after analysing the discrepancies[5], a system which General Walker describes as

not calculated to elicit results of the full accuracy which an instrument can be made to give, and the method of treating the results was somewhat arbitrary, and would not now-a-days be

[1] DDn. 61, 10–3–02. [2] Observing only 2 angles of each triangle. [3] DDn. 63 (72), 24–4–02.
[4] Astronomer-Royal 1765–1811 [I, 55 n.13]. [5] TS. I (63) ; quoted *GTS*. I (xviii).

considered justifiable ; but the processes were quite on a par with the contemporary operations of European geodesists, and it would be unreasonable to expect a higher order of accuracy...in a work which from the outset was beset with many difficulties, and was carried on at so great a distance from the centres of civilization and science.

The difficulties which Major Lambton alludes to as arising from the haziness of the weather might have been materially diminished had he been supplied with luminous signals, ... but such signals were not employed...until after the year 1832. ... For very many years the signals were "masts, flagstaves, and other opaque objects, and then days and days often passed away without a glimpse of the distant objects ". As the atmosphere in India is usually most favourable during the rainy season for viewing such objects, it became the practice to wait for the first heavy fall of rain, and then take the field[1].

Few stations were permanently marked. If Mackenzie and his assistants were never certain of the exact point on a hill-top from which Lambton had observed [206, 208], it was altogether impossible for the observers of the Great Trigonometrical Survey to identify stations with precision sixty years later.

For purposes of description and calculation Lambton divided his chain of triangles across the peninsula into six "great distances", or east-to-west sides[2]. From three of these he obtained independent values for the length of a degree of longitude, but, he writes,

it is...desirable that many more measurements of the kind should be made, and that other methods should be tried for getting the length of a degree of longitude, particularly that of carrying a good time-keeper between the two meridians at a known distance, a method which has been strongly recommended to me by the Astronomer Royal, and which I mean to put in practice in the course of my future operations.

I had also devised another method, by the instantaneous extinction of large blue lights fired at Savendroog, the times of which were to be noticed by observers at Mullapunnabetta and Yerracondah, the distance of whose meridians...being nearly 135 miles. The experiments were attempted [Warren firing the lights and Lambton and Kater observing], but the weather was so dull that the lights could scarcely be distinguished. There is besides a difficulty in fixing the precise moment of extinction ; ... but the mean of a great number of successful results might come very near the truth[3].

In 1800 Lambton obtained a value for the height of his base at Bangalore by means of barometers brought up from the sea at Madras [256], and in 1802 he connected his base at St. Thomas' Mount to the low-water line [257]. The base at Tanjore was connected to the beach at Nagore by triangulation. Vertical angles were taken with the principal triangulation, and heights thus carried forward from the base-lines and the sea. In his report on the triangulation across the peninsula he added

a table giving the perpendicular height of all the great stations above the level of the sea, and the ultimate comparisons of the height of a station on the beach near Mangalore, as had by computing from this coast [east], and by measuring from the low-water mark on the other, where there appears an error only of 8.6 feet. This table also contains the terrestial refraction[4].

This close agreement was, however, largely fortuitous, and the heights deduced were far from precise, largely owing to uncertainty about refraction, of which Lambton writes in 1814 ;

In the course of my observations during the last ten years, I have at times found the terrestial refraction to be as much as $\frac{1}{4}$ of the contained arc, and occasionally as low as 1/20th. This great irregularity I attribute to the different degrees of moisture in the atmosphere at different times.

A knowledge of the laws of refraction is yet a desideratum in physical science. In climates remote from the equator, where the weight of the atmosphere is constantly changing, the barometer has been called in to indicate the pressure of a column of air. ... But in tropical climates this method can never apply, owing to a well-known fact that the weight of the atmosphere suffers very little variation. ... Other principles must therefore be adverted to. The hygrometer will be a necessary instrument to indicate the degree of moisture.

[1] *GTS.*, I (xix). [2] The six sides were, Carangooly–Karnaticghur ; Kylasghur–Yerraconda ; Yerraconda–Savendroog ; Savendroog–Mullapunabetta ; Mullapunnabetta–Balroyndroog. The meridians passing through these stations, as well as through the Observatory and Doddagoonta were used for reference purposes, those between Karnaticghur and Kylasghur being nearly coincident [pl. 16]. [3] *As R.* X, 1808 (367). [4] ib. (382) ; cf. TS. I (15).

It will be necessary to observe what the horizontal refraction is at different heights above the sea, ... and also what is the refraction at 45° of altitude at those different heights. These data may enable us to discover some law by which the density of the air decreases in ascending from the surface of the earth. ... I shall endeavour...to attain all this; and shall at all events construct a table of refractions for low altitudes determined from actual observation[1].

Both his assistants helped in these investigations. Warren published *An account of experiments made in the Mysore Country in the year 1804 to investigate the effects of Terrestial Refraction*, and Kater published a *Description of a very sensible Hygrometer*[2], which was a species of grass particularly sensitive to humidity.

Writing of fortuitous agreements that are always comforting to earnest surveyors who seek for precision beyond the capacity of their instruments or methods, Walker points out several instances where Lambton's results flattered the accuracy of his methods[3], but it was Lambton none the less who first led Indian surveyors to aim at high precision.

GEODETIC RESULTS

The geodetic results of Lambton's work have been discussed in detail by General Walker and Sir Sidney Burrard [233 n.1], and it is only necessary here to give a brief summary of Lambton's most notable contributions to a science of which he was India's pioneer[4].

The determination of the length of a degree was essential for the computation of triangles and the position of points and for the preparation of a table of the lengths of a degree, both in latitude and longitude, for the projection of maps[5] [215].

To make this determination it was necessary to observe the astronomical difference of latitude between two selected stations, and compare that against their distance apart as measured by triangulation.

Lambton's first meridional arc was measured along the Coromandel coast during 1802-3 [236-8]. His only measures of longitudinal, or perpendicular, arc were made during his measurement across the peninsula 1803-4, being deduced from observed latitudes and azimuths[6]. Treating these as preliminary values only, he took his main central arc as the line on which to make future deductions, and the following table gives the stations of observation which formed the terminals of the several sections of this great arc.

Station	Locality	Approx. Lat.	Dates of observation	
Punnæ	Cape Comorin	8° 10′	March-April	1809
Pachapālaiyam	Coimbatore	11° 0′	April-May	1806
Doddagunta	Bangalore	13° 0′	July-August	1805
Bommasundra	North Mysore	14° 0′	June-August	1806
Namthābād	Gooty	15° 6′	April-May	1811
Damargidda	Bīdar	18° 3′	Jan-March	1815

These observations were made with the zenith sector [252], and Lambton made it a rule to observe to the same stars, so far as possible, at the same season of the year at each station. The care he took over the observations is illustrated by the building of the masonry observatory at Punnae, with arched roof and solid pillar for the instrument[7].

For computing the spherical excess of his first triangles of 1800–2, and the latitudes and longitudes fixed from them, he took "the length of a meridional degree

[1] TS. III; DDn. 91–107. [2] *As R.* IX, 1807 (1, 24). [3] *GTS.* I (xxiv–v). [4] For a clear history of early work on the figure of the earth, *v.* J. Howard Gore's *Geodesy*, and Dr. de Graaff Hunter's lecture to 15th Indian Science Congress, Calcutta, 1928. [5] DDn. 63 (222–4), Pondicherry, 24–7–10. [6] Burrard (17–23). [7] TS. II (4, 50).

in latitude 13° as 60191 fathoms" as determined "by the French mathematicians and by General Roy", and used Sir Isaac Newton's value 1/230 for ellipticity[1].

From his meridional arc of nearly 1° 35′ measured during 1802–3 [236-7], he deduced a length of 604494 fathoms to a degree, which he used for the computations of his new series across the peninsula. From his first two east-to-west distances the values deduced for a degree of longitude were not only discordant between themselves, but also with the assumed value for ellipticity. A repetition at one of these stations making practically no difference, Lambton rejected the results from his first distance, for, writes Burrard,

the observations...between Karanguli and Karnatakgarh had been made under great disadvantages, and Karnatakgarh itself was by no means an eligible station ; on its west was situated a great mass of mountains, and to the eastward only a low sandy plain, and Major Lambton conjectured that his instrument had been sensibly affected by the lateral attraction produced by such an inequality of matter[2].

Walker gives the following account of Lambton's problems ;

For several years...Lambton computed the latitudes and longitudes...with the elements of the figure of the earth which were afforded by a short meridional arc in the neighbourhood of Madras, and by the mean of the two values of the perpendicular degree in latitude 12° 55′. ... An arc of about 2° in length was measured from...Dodagoontah, near Bangalore, southwards to Patchapollium ; it made the length of the degree 60530 fathoms in latitude 11° 59′ 55″. This arc was then extended northwards to Paughur, making...60466 in latitude 12° 33′ 9″ [240-1].

Thus it was evident [either] that the elliptical hypothesis of the earth's figure was erroneous, for the lengths...were apparently decreasing instead of increasing with the latitude, or that the operations were...erroneous. ...

Similar anomalies had perplexed most of the geodesists of that time, and have given rise to much discussion ; it is now well known that they are due, for the most part, to deflections of the plumb line by local attraction at the astronomical stations. But at that time many persons supposed that they arose from errors in the observations. ...

But Colonel Lambton appears from the outset to have conjectured that the discrepancies in his operations arose from local attraction ; and thus, instead of revising his triangulation or his astronomical observations, he immediately proceeded to select new stations, which were less liable to...the attraction of hill and superficial irregularities. ... Thus Paughur, being on the "northern extremity of a range of rocky hills running north and south", was rejected, and the station of Bomasundrum, in an open plain, ... was adopted instead [241].

The result was disappointing, but

he still...had an intuitive conviction that the discrepancies were due to local attraction, and he attributed them partly to the influence of the great table land to the south of Bomasundrum on which Dodagoontah is situated, and partly to "a vein of dense ore lying between the two stations". He concluded that it would be impossible to arrive at more accurate values of the measures...until the operations, both in Europe and India, had been further extended, but that what had been done up to that time "had discovered to us an agent unthought of in former days, viz., a disturbing force occasioned by the attraction of mountains, and by *diversity in the density of strata under the surface*, all of which will...cause some deflection of the plumb-line". ... Lambton was prepared to recognize the influence, not only of mountain ranges and other self-evident irregularities...but of variations in density under the surface, ... which are possibly of more importance than the superficial irregularities. ...

In Lambton's own words ;

In the great measurements in France & England the plummet was affected where no mountains existed, and I have found the observations in this country disturbed at a station on the Tableland near Bangalore about 20 miles from any mountains.

These irregularities have been so great in France and England that it would be absurd to attribute them to errors in observing. As those observations were made at a distance from Mountains, it was natural to impute the anomalies to attraction in causing a deflection of the plumb-line, and this could only be accounted for on the supposition that the earth is made up of masses of different densities[3]. ...

Let the Figure of the Earth be what it will, we may venture to abandon the hypothesis of uniform density from which Sir I. Newton drew his conclusions[4].

Walker continues ;

[1] Burrard (9) ; *As R.* XII, 1818 (366–8). [2] Burrard (21). [3] TS. III (10). [4] ib. I (20).

The next meridional arc, ... an extension southwards to the vicinity of Cape Comorin, ... made the length of the degree 60473 in latitude 9° 34′ 44″. Operations were subsequently carried northward to...latitude 15° 6′ [246, 260], which made the length of the degree 60487·56 fathoms in latitude 13° 2′ 55″.

As the results...were very fairly accordant *inter se*, and with those of recent European arcs, ... and as the three astronomical stations were to all appearance much less liable to be affected by local attraction,

Lambton accepted these and rejected his results from the intermediate and doubtful stations[1]. Walker points out that observations taken in this region more than fifty years later support Lambton's deductions as to the deflection of the plumb-line[2], but J. D. Herbert was amongst those who ridiculed the idea. Neither he nor Hodgson ever suspected the abnormal deflections which had disturbed their observations round Dehra Dūn in 1816–8, and he writes in 1830 ;

The discrepancies found in comparing consecutive degrees in all the great surveys of England, France, and India, has been attributed either to irregularities of the earth's figure or to disturbances of the plummet. Were this the place to dilate on the subject, we are prepared to shew that a very large share of these discrepancies is due to unavoidable errors of observation, and to nothing else[3].

In 1812 Lambton received new values of the earth's figure from Europe, giving ellipticity as nearly 1/304. These induced him to throw out all his earlier values[4], and recompute the whole of his great central arc up to Gooty. Then, after he had extended it further to Bīdar, to an amplitude of nearly ten degrees, he worked out his own constants and in 1818 recomputed the whole arc again[5].

In 1821, on receiving from England the report of the Parliamentary Committee on the Standard of Length, and Kater's reduction of Cary's brass scale to that standard [267], he patiently set to work to re-adjust all his computations, and derived final values given below[6].

Owing to its great length and proximity to the equator, Lambton's measured arc became an important contribution to all later investigations of the figure of the earth more especially in those deduced by Everest and Bessel. The following are the essential elements as calculated by Lambton and others[7].

	Semi-major Axis (a)	Semi-minor Axis (b)	Compression $\frac{a-b}{a}$
	Feet	Feet	
Lambton	20918747	20851326	1 : 310·28
Everest 1st.	20922931	20853374	1 : 300·80
„ 2nd.	20920902	20853642	1 : 311·04
Bessel	20923600	20853656	1 : 299·15
Clarke 3rd.	20926062	20855121	1 : 294·98

COMPUTATIONS AND RECORDS

A large part of Lambton's time was taken up by computations, for which he only had the assistance of the young men from the surveying school [346]. As he completed each stage of his General Survey, he prepared several copies of his report, which contained a review of the work accomplished—a general summary —full details of base-measurements, triangles, astronomical observations—lists of geographical positions—and discussions on the geodetic results. He generally sent in advance charts of the triangles, supplemented in some cases by a geographical sketch, extra copies being made for Mackenzie and others.

At the start of the work the Madras Observatory was taken as the point of departure for all computations, but in 1805 the station Doddagunta, near Bangalore, was substituted, being nearly in the centre of the peninsula, on a table-land remote

[1] *As R.* XII, 1818. [2] *GTS.* I (xx–xxiv). [3] Warren (81). [4] Everest (2). [5] *As R.* XII, 1818 (6); *GTS.* I (xxi). [6] Burrard (48–56). [7] ib. (58).

from mountains, and situated at the intersection of two main chains of triangles. In the first two reports longitudes were referred to the six principal meridians fixed during the operations across the peninsula [238, 239 pl. 16].

In his report on the measurement of the first base-line at Bangalore, Lambton writes ;

I have given a short but detailed account of the observations for determining the latitude and meridian line, and...the principles of the computations ; and...I shall for the future subjoin to every sketch a memoir similar to this, containing an account of such astronomical observations as may be found necessary, and the method by which the latitudes and longitudes...are determined. It may also be proper that a list of the triangles should accompany each Report, so that they can at all times be referred to. ...

The principal triangles...should be accompanied with every document to render them satisfactory, the correction of the observed angles depending on principles not very generally understood[1].

In a later memoir he explained that,

the tables of latitudes and longitudes being the result of all the other operations and the ultimate object of the Survey, I have been as particular as it was possible...to render it of general use in assisting the surveyors of Districts. The table of distances and the descriptions of stations are likewise intended for that purpose[2].

The report on his meridional arc in the Carnatic was submitted in October 1803, one copy being passed to the Asiatic Society at Calcutta, and published in *Asiatic Researches*[3]. This report forms part of the first volume of the manuscript reports of the Trigonometrical Survey, the second part, covering operations across the peninsula, 1803–6, not being submitted till July 1807. In para 39 Lambton discusses "Amplitudes of the Arcs" and "Discrepancies in the Observations attributed to a deflection of the plumb-line by mountain masses or mineral veins"[4].

The second report, *1807 to 1811*, was submitted from Masulipatam in February 1812 [246][5], the *General Map of the South Peninsula* having been submitted with a memoir in December 1810 [244].

Lambton had for some time found the indoor work taking up more and more of his time, and had been deputing even the principal triangulation to his assistants. In pressing for the retention of Riddell and Hodge, he points out

the advantage of having assistants, ... for, had I been alone, and now altogether occupied in making out a tedious report, no other work would have been done, and the whole of my large establishment must have remained idle, and...it is to be regretted that any part of them should remain inactive while I am bringing up my work indoors, which takes up much more time than the field work[6].

In submitting the second report he writes ;

I have forwarded a copy of this Report to the Surveyor General and shall keep another in my possession. Should the Honorable the Governor in Council be pleased to forward this one to England and wish to be supplied with another, it may be made out at some future date, as I am anxious to avail myself of the favourable season ; and to copy one of these Reports requires considerable time. It is however necessary that it should be done under my own eye, and by persons acquainted with the different tables and formulæ.

I propose making my next stand at Adoni, which I hope to reach before the setting in of the west monsoon, and shall be then more at leisure to attend to indoors work during the rainy season.

He points out to the Surveyor General that the report contains

tables of all the principal and secondary triangles, and the latitudes and longitudes of places deduced therefrom. There is also the measure of degrees on the meridian from 8° 30′ to 14° 30′, but the lengths of degrees of longitude have not yet been computed, as I wish to wait the results of more extensive measurements in Europe [262], as well as of my own in these latitudes, before any general determination be made.

In the course of the present and ensuing years, I hope to be fully satisfied on these subjects, when I shall be able to construct tables of the measures of degrees...which will be of use to you

[1] DDn. 63 (49), 18–10–01. [2] DDn. 61, 10–3–02. [3] *As R.* VIII (137–93). [4] TS. I part II. See also *As R.* X (291–384), & BM Addl MS. 13658, a copy presented by family of Marquess Wellesley, and also IO Lib. 49 H. 8. [5] cf. *As R.* XII (i-101 ; 286–365) ; XIII (1–127). [6] MMC. 1–10–11.

in constructing maps, and in computing the positions of places in latitude and longitude... carried on by the common theodolite [260][1].

MS. Reports III and IV were not completed till 1818, and then not only covered the work from 1811 to 1814, but also gave "a retrospective view of the operations from the commencement to the completion of the Peninsula", with latitudes and longitudes of all points fixed since 1802, computed on the new elements that Lambton had now deduced for the figure of the earth [262]. Report III, besides containing all subsidiary series of triangles by Lambton's own assistants, contained Garling's work on the east coast and in Goa and Sonda [158, 255][2].

With the report of 1818 was a chart in 8 sheets covering the work done south of the Kistna. This was later engraved by Walker and published in 1827 by Horsburgh, the Company's Hydrographer[3]. There were 20 engraved sets and one manuscript in the Surveyor General's office in 1840[4]. The only sets, a printed one, found in 1947 is coloured by hand to distinguish the various chains and series, and has pencil entries of dates and observers' initials at most of the stations. These entries appear to have been made by Joshua De Penning[5] from records kept by himself and Lawrence. Other published charts include ;

Meridional series on Coromandel Coast, and Longitudinal series across Peninsula, 1802–6.

Central arc from Pachapālaiyam to Namthābād, parallel 15° 6′, Great Arc from Cape Comorin to Bīdar, in two plates[6].

The computing office at Dehra Dūn now holds two copies each of these MS. Reports, Nos. I to IV. The second copy of Report I does not contain part I dealing with the work earlier than October 1803. This omission caused much concern to Blacker in 1824[7], but the missing part is probably the copy in the Wellesley collection at the British Museum[8] [263 n.4].

No charts are found in the first copies of Reports I and II, nor in either copy of Reports III and IV. The triangles shewn on plates 16 and 17 of this volume are taken from charts in second copies of Reports I and II.

Accounts of the geodetic work were published in *Asiatic Researches*[9], whilst an abstract of the measurement of the great meridional arc appeared in the *Philosophical Transactions of the Royal Society*[10] of 1818.

It has always been difficult to compile a connected account of Lambton's work, owing, as is pointed out in a review of 1845, "to the total absence of dates in Lambton's accounts as published in Asiatic Researches"[11]. Such disregard of dates has already been noticed in Rennell's *Memoir of a Map of Hindoostan* [I, 28 n.5].

APPRECIATIONS

Though the importance of Lambton's work was fully appreciated by a few wise persons from the very start, it was not for some years after the publication of his early reports that he won recognition from influential officials in India, and scientists in Europe. Warren, who had been his constant companion between 1802 and 1805 has left an account of Rennell's first mistaken criticisms and subsequent *amende honorable* after Maskelyne's intervention [I, 376 ; II, 251]. He continues;

The Members of the Finance Committee of Madras appear to have had great difficulty in comprehending the object of Colonel Lambton's survey. The manner in which one of their leading members illustrated the opinion of the Committee is sufficiently original to be worthy of preservation. ... "If any traveller" he says "wished to proceed to Seringapatam, he need only say so to his head palankeen bearer, and he vouched that he would find his way to that place without having recourse to Colonel Lambton's map"[12]. This committee plagued Captain Lambton with endless absurd questions and comments [334–5] ; and, he having consulted his feelings rather than his judgement in some of his answers, offence was taken, and the matter reported to Lord W. Bentinck[13]. His Lordship, who patronized the work out of

[1] DDn. 63 (279–82), 11–2–12. [2] *IO Cat.* [3] MRIO. Misc. 1–0–14. [4] *Ben Regr.* 586 (24). [5] in charge computing office, 1832–42. [6] *As R.* X (298) ; XII (294) ; *Phil Trans.* cviii. [7] see note in fly-page. [8] BM. Addl. MS. 13658. [9] *As R.* VII, VIII, X, XII, and XIII. [10] Vol. VIII (486–516). [11] *Cal. Rev.* IV (80). [12] ib. [13] Govr. of Madras, 1803–7.

kindness warned him against giving way to his feelings in a public correspondence; but he would take no concession, and declared that "if he were to be placed, anyhow, under the control of persons who could not possibly understand the nature of his business, and who acted with ill-will towards him, he begged to withdraw from his undertaking". Lord Bentinck was pleased to overlook this proof of sturdiness, and even promised him his support, provided he would learn to temporise, and attend to the decorum of official forms.

There were however others who strongly supported the work. The Quartermaster General, Lt.Colonel John Munro [196 n.4], having heard that the Government contemplated the abolition of the survey, waited on the Governor for the purpose of representing the utility of the operations in a military point of view, more especially as exhibited in the results of the Topographical Survey then carrying on, the triangles of which rested on the positions determined by Captain Lambton. This survey was the work of the Military Institution [125–6]. ... He had the merit of stating his views in so forceful and convincing a manner, that the intention to abolish the survey was abandoned.

Captain Lambton also had a warm friend and admirer in Mr. Scott of the Madras Civil Service [9, 195]. ... He was first Judge in the Court of Appeal, but owing to his well-known attainments was generally consulted by the Government on all questions as had any connection with science[1].

The correspondence with the finance committee, and the support given by Bentinck are referred to later [334–5], but appreciations by William Petrie[2], who acted as Governor after Bentinck's departure, and by Andrew Scott, may be quoted here. Petrie writes;

I have repeatedly submitted to the Hon'ble Company my sentiments of this splendid work. Its merits...require no proofs of my testimony, & when the Fame of Conquest & Extensive Dominion has passed away, a page may remain on the Records of Science to shew that under the fostering & liberal protection of the East India Company, a Survey has been carried on in a part of their Eastern Empire, verified & determined by a Series of Astronomical & Mathematical Measures, not inferior in Science & Accuracy to the Brilliant Labors of the English & French Astronomers.

The value of Major Lambton's work has been justly appreciated, not only by Mathematicians in our own Country, but by that distinguished Learned Body...at Paris. In that Department there can be no national warfare[3].

Scott writes;

The...very great importance of Major Lambton's Survey, is...but little understood. I fear there are but few among us who consider the ascertaining the lengths of three or four degrees of the meridian, and as many of Longitudes, as of any importance, or who conceive that much scientific knowledge, or much labour, is necessary for accomplishing it.

The opinions of the Learned in Europe, however, are very different; witness the expensive expeditions sent by the French to the Polar Circle & Equator. ... Major Lambton will, if not prematurely interrupted, in a short time have ascertained the length of a greater arc of the Meridian than was done either in Lapland or Peru[4]. ...

It is only by having the correct length of degrees of the Meridian and Longitude in different Latitudes that the great desideratum can be obtained, of establishing what the true figure of the Earth...really is; some may consider this a matter of mere curiosity, without considering its real importance in Navigation, Geography, & Astronomy, &, where France has done so much & they are still going on in England, do not let us be so stupidly ignorant as not to set a proper value on what Major Lambton is doing[5].

Lambton was greatly heartened by a letter from Maskelyne written after the discussions with Rennell, and he replied in October 1806;

Your obliging letter of the 30th May 1804 I acknowledged last year when I was on the Malabar Coast, having at that time extended the trigonometrical operations across the entire peninsula of India. As you expressed a wish to be further informed on the success and progress of this survey, ... I shall now give you...the outlines of what has been done. ...

A series of principal triangles has been carried direct from Fort St. George to Mangalore for...connecting the two seas by actual measurement. In performing that task great attention has been paid to...the length of a degree of longitude, that the comparative position of Mangalore with the Observatory at Madras might be finally ascertained. ...

Among the subjects which are purely scientific, the measurement of an extensive arc on

[1] Warren (77–8). [2] Mad. Civ. 1765; amateur astronomer [I, 171]; Member of Council from 1791; actg. Govr. Sept.–Dec. 1807; Govr. PWI.; d. 27–10–16. [3] Gore (81–94, 96–112). [4] Mack MSS. LVIII, 4–9–08. [5] ib., 9–9–08.

the meridian will doubtless [attract] the first attention, being...a grand desideratum to compare with what is doing in England and France, and with what has recently been done at the polar circle.

After describing his work on the central meridional arc, he continues ;

This short sketch will enable you to form a judgement to what extent this work had already been carried, the useful purposes in geography to which it may be applied, and above all, its importance in the more sublime branches of general science ; and, if my labours are crowned with the success which my ambition leads me to hope for, it will be owing to that munificent liberality for which the Honourable the Court of Directors are so justly distinguished, ... and to the uniform support which, from the beginning, I have experienced under the Government of Fort St. George[1].

When submitting his official report to Government the following year, he annexed a paper, with a request that it may be submitted...to the Astronomer Royal, and finally to the Royal Society. ... This paper is collected from what is contained in the Report, being that part of it which relates to philosophical subjects, and which will, I trust, prove acceptable to the learned societies in Europe[2].

We have, unfortunately, no copies of Maskelyne's letter, but it was doubtless through his help that Lambton received accounts of the latest geodetic work in Europe [262]. According to Everest the only appreciations that Lambton received from Europe before Warren's visit to Paris in 1816 were those of ;

the Rev. N. Maskelyne, and the late Professor Playfair ; of whom the former...addressed him by letter, and the latter made his labours a subject of discussion in some of the ablest articles of the Edinburgh Review[3]. ...

To this moment I remember well the gleam of gladness with which my old master used to refer to the fact of Nevil Maskelyne's letter. It had reached him apparently in an appropriate hour, when he was surrounded with difficulties. ... With this solitary exception, until Professor Playfair took the subject up, ... he was to appearance forsaken of all, and left to struggle alone, ... whilst his labours were treated by all his countrymen...with the most superlative indifference and neglect[4].

General Walker writes in 1870 ;

Of all Colonel Lambton's contributions to geodesy, the most important are his measurements of meridional arcs, the results of which have been employed up to the present time, in combination with those of...other parts of the globe, in all investigations of the figure of the earth [262][5].

In 1861 Everest, who had then been long retired, suggested to the Royal Society a re-examination of Lambton's records regarding the Great Arc. He pointed out that the only published accounts were scattered through

the Asiatic Researches, and if it is intended that these should be permanent data, they ought to be collated and combined into one volume. The details...are to be found in manuscript copies ; ... and, as in transcribing there is always a liability to clerical errors, ... a volume... ought to be drawn up after a rigorous comparison with the manuscript. ...

All the celestial observations for amplitude...were reduced many years ago ; but...the constants and formulæ...have undergone vast alterations since that period, and of course corresponding recomputations would now be necessary. ...

If this were effected, we should at least have the satisfaction of knowing that the most had been made of the...operations, which indeed might fairly rank with those of MM. Bouguer and De la Condamine, or MM. Maupertuis, Clairaut[6], and others, though, from the inferiority of instruments and other causes, of course they could not be classed for accuracy with those of a more modern date. ...

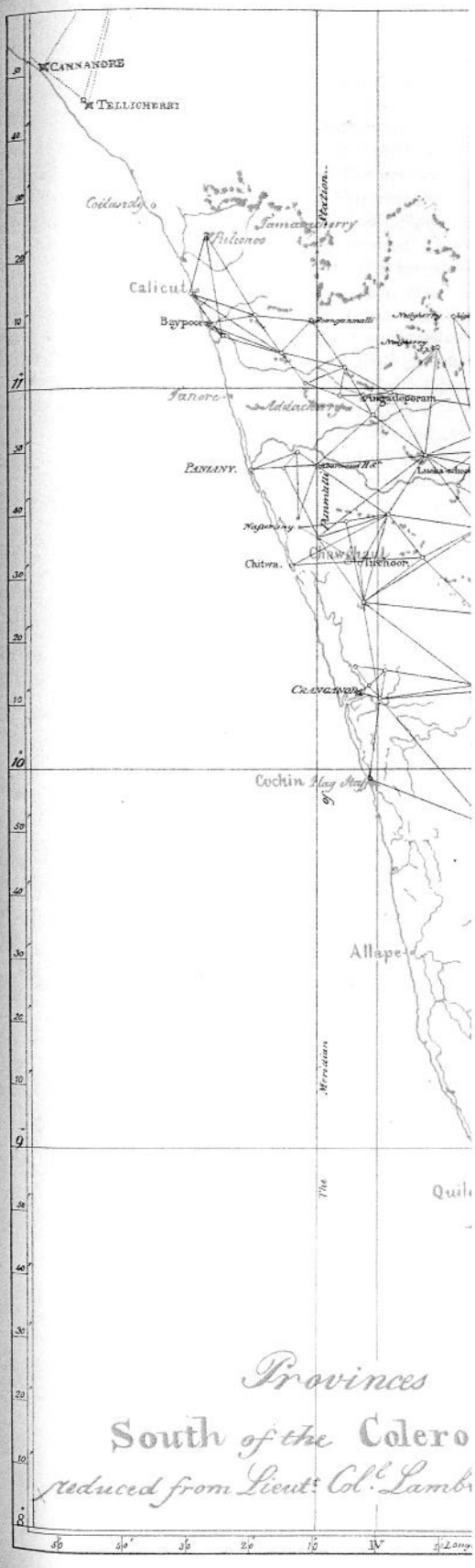
It is not creditable to leave this subject in its present disjointed state. India furnishes the largest extent of territory accessible to Great Britain in which arcs of the meridian can be measured, and...from Cape Comorin to the Himalayan Mountains one uniform triangulation ought to be formed.

The Royal Society appointed a committee which made the following report ;

No good whatever would be done by an examination of the Angle-Books. It is evident from Mr. De Penning's statements that the utmost care was used, and the best judgement... exercised at a time when all the qualifying circumstances of the separate observations were known. ...

[1] DDn. 63 (144–7), 15–10–06. [2] ib. (157–8), 16–9–07. [3] of 1813 *et seq.* [4] Everest (17–8).
[5] *GTS.* I (xxii). [6] French geodesists.

Plate 17


CANNANORE
TELLICHERRI
Coilandy
Famacan Surry
Mahe
Calicut
Baypoor
Tanore
Addacherypa
Angadeporam
PANIANY.
Napurny
Chitwa.
Tiruhoor
CRANGANORE
Cochin
Allapee
Meridian
Provinces
South of the Colero
reduced from Lieut.t Col.l Lamb
Long.

In regard to the accuracy of the calculations of the sides of the triangles, ... the committee recommend that they be verified. Of...the computation and aggregation of successive portions of the meridian, ... the committee recommend that this important calculation be repeated. ... The details of the base-measure reductions admit of easy verification, and the committee recommend that they be verified. ...

The portions of the arc surveyed respectively by Colonel Lambton and Sir George Everest join each other at Damargida ; and there is a large discordance between the elevation of this station, as given first by Colonel Lambton, and secondly by Sir G. Everest and Sir A. Waugh. ... The committee recommend that Colonel Lambton's...height...be rejected. ...

The reduction of the latitude observations was corrected many years ago by Bessel. The committee are of opinion that additional accuracy can now be given to these corrections. ...

The committee have had personal experience of the great inconvenience caused by the dispersion of Colonel Lambton's accounts...through numerous volumes of the Asiatic Researches, and, viewing the limited circulation of that work in continental libraries, they are inclined to believe that very few men of science have it in their power to form a correct judgement as to the value of Colonel Lambton's great work. The committee therefore recommend that, when the verifications and corrections...have been made, the whole be published in one volume, ... and sufficient numbers (say 500 copies)...presented to all the known libraries, academies, and observatories of importance throughout the world. ...

The committee...call...attention...to the general quality of Colonel Lambton's Surveys which, though executed with the greatest care and ability, were carried on under serious difficulties, and at a time when instrumental appliances were far less complete than at present. ... The Standards of length are better ascertained than formerly, and all uncertainty of the unit of measures can be removed. The base-line apparatus can be improved. The instruments for horizontal angles used by Colonel Lambton were inferior to those now in use ; and one of them was most severely injured by an accidental blow, the result of which was more distinctly injurious, because the circle was read by only two microscopes [254]. ...

Though the astronomical observations were probably good for their age, yet new observations conducted with such instruments, and on such principles, as those adopted by Sir George Everest, would undoubtedly be better. The committee therefore express their strong hope that the whole of Colonel Lambton's Survey may be repeated with the best modern appliances.

On further review, the revision of computation was considered waste of time ; and the southern part of the Great Arc was entirely re-observed between 1866 and 1874 as had been first recommended by Everest in 1842 ;

All Colonel Lambton's stations, both principal and secondary, that are likely to be still in existence, such as marks on rocks, have been incorporated into the modern trigonometrical survey as secondary points for use in topographical work, whilst those, such as flag-poles, that seem from his descriptions to have been of a temporary nature, have been rejected. None of his work remains as principal[1].

[1]Burrard, (62).

CHAPTER XIX

MAPS

Lower Bengal — Upper Provinces — Punjab & Afghānistān — Calcutta Drawing Office — Madras — Madras District Maps — Madras Drawing Office — The Deccan & Mālwa — Persia.

IT was very many years before district officers and other officials in lower Bengal had any better maps than those of Rennell's *Bengal Atlas* [I, 227–30], but amongst the few exceptions was a map of the environs of Calcutta prepared from Fleming's survey of 1801–2 [12-3]. To meet the police demand for such a map in 1800, the Surveyor General compiled a *Map of the Country from 30 to 40 miles round Calcutta* from material in his office. It was on scale two miles to an inch, the southern and western areas being taken from Claud Martin's survey "of Part of the Calcutta Lands" [I, 51–2], and the remainder from Cameron's survey of the 24-Parganas of 1761–2 [I, 13].

This map was found sufficiently important in 1831 to be copied as it stood, and, after incorporation with Fleming's survey, was amongst the first maps heliozincographed at Calcutta some thirty years later.

Upper Provinces

In 1800 the Surveyor General submitted a new map of Oudh, and promised to follow it up with one that should include the new surveys by Thomas Wood [26], and he later reported that,

in addition to a new general map of Hindostan which I have for some time been employed upon [I, 220; II, 281] I have now made some progress in a new general map of Bengal and Bahar upon a scale larger than had hitherto been adopted and...I purpose likewise to construct a new map of the Upper Provinces[1].

The cession of Gorakhpur, the lower *doāb*, and Rohilkhand, later in the year [26] led to an immediate demand for maps, and the newly appointed Collector of Cawnpore asked for

maps of this part of the Doab formed from the latest surveys. ... The small scale of Major Rennell's Maps[2] cannot be of much service in defining the necessary particulars...for...furnishing reports and information of the country. ... They are not also so late or accurate, and do not include all the villages and lands, which newer surveys...have effected.

The Surveyor General made up the best maps he could, but at the same time told Government that

the Dooab [I, 229] has been hitherto but imperfectly surveyed, and as it will be necessary to supply...a map of his District upon an enlarged scale, and very minute in the detail, I would take the liberty of recommending that an officer be employed to survey such parts of it as are least known. ... [The Collector should send] lists of all the Purgunnahs, and Talooks, principal towns, and Cutcheris, written in the Persian character and in English, stating...their distances in estimated coss, and directions, ... from two or three well-known places[3].

Macdougal was deputed to Cawnpore, Wood to the western boundary of Oudh and Smyth to the eastern boundary [27], and, in the meantime, Colebrooke submitted a map of the ceded boundaries, which has been constructed from the best materials in the office.

[1] DDn. 67, 14–3–01. [2] 5 miles to inch. [3] B Pol C. 29–4–02.

... This map can convey little more than a general idea of the...late acquisitions, as it was impossible that the boundaries between the ceded districts and those remaining to the Nabob could be accurately laid down. I have endeavoured from the best information which I could collect...to fix the positions of such of the Towns and Districts named in the Treaty as could not be found in the old maps, but these, until new surveys are made, must be considered as doubtful[1].

In March 1804 he reported that

the surveys...by Lieutenant H. C. Smyth and Ensign Macdougal...have not been completed, the former having been ordered to join the Army in the Field, and the latter having been called down to the Presidency, before their respective surveys had been finished.

The Field Books...will, however, enable me to fill up a portion of the new maps of the Ceded Provinces, which are now in hand. But, for the purpose of completing this work, which is to be divided into a set of provincial maps for the use of the Magistrates and Collectors, ... it would be very desirable to have Persian Schedules of the names of the principal places in each district, and when the roads have not been regularly surveyed, routes or itineraries in Persian, containing the stages and estimated distances from one Capital of a Province to another, or generally between all the principal cities and towns[2].

By the end of 1804 he was able to submit a revised general map, but

the Provincial Maps of the Ceded Countries, which were begun some time ago, have...been unavoidably postponed, as my own personal exertions are unequal to the...work in hand, having failed in my endeavour to procure an Assistant properly qualified [272][3].

The amount of work which Colebrooke managed to turn out, with only three or four draughtsmen, was enormous [271–3], and in 1806 he submitted yet another

map of the Ceded and Conquered Provinces in Upper Hindoostan, comprehending also the countries West of the Jumna, drawn from the latest surveys and astronomical observations... [and had] made considerable progress in a New Map of the Ceded and Conquered Provinces including the Seat of the late War and Brilliant Victories in Upper Hindoostan, which I presume might become very useful for Military purposes in case of a renewal of the War ; but, as the utmost number of copies of this, or the General Map, which could be taken in Manuscript must necessarily...be very small, I...request permission to publish them, whenever they may be sufficiently finished to admit of my transmitting them, or proceeding myself, to England [281–2][4].

Amongst the few large-scale provincial, or district, maps he completed was one of Morādābād and part of Bareilly from the surveys of Mouat and Wood[5] [I, 56–8], which shows the Ganges in considerable detail, but only gives one or two routes south from Morādābād and the *supposed* district boundary. Colebrooke explains ;

First. The materials which have been collected in this office...are not sufficient for the construction of any particular and accurate maps of the Districts in question, as the routes which have been surveyed through them can furnish little more than a sketch or skeleton map, in which one quarter of the principal towns or villages would appear. ...

2ndly. That to construct a map, even of this kind, the scale of which should not be less than one Inch to a mile to contain all the villages in the surveyed parts, it would be necessary that I should be allowed an assistant from the Engineer Corps, properly qualified to make the projection for the map, and to insert all the materials. ...

3rdly. That I could not myself, without laying by for a considerable time the General Maps which I have in hand and which...it is my duty more particularly to construct, undertake the map in question.

4thly. ... I lately received a letter from the Collector of Moradabad upon this subject, and...informed him of the difficulties under which I laboured. At the same time I requested of him to supply me with certain Routes from the information of Natives, which might help me in the construction of a map of his district, but to which application he has not replied[6].

The Magistrate wrote in later, on Colebrooke's advice, and asked for copies of the one-inch surveys of Mouatt and Wood,

to aid me to form a sketch of the whole district on a similar scale, which shall contain every village in the district, and which I deem essential for the purpose of police, especially in a district which has so long been subject to the depredations of gang robberies[7].

[1] MRIO. Misc. 7–0–1802, 16 m. to an inch. DDn. 67 (7), 2–3–02. [2] ib. (305), 14–3–04. [3] BPC. 4–4–05 (31). [4] ib. 23–3–06 (72); BMC. 6–11–06 (5). [5] MRIO. 16 (53); ib. 17 (19) is an unfinished map of similar area from surveys of 1799–1802. [6] DDn. 81 (35), 25–10–06. [7] DDn. 82 (9), 8–3–08.

It was in order to collect material to complete his maps of Oudh and Rohilkhand that Colebrooke undertook the tour that led to his death [28–33], and he was looking forward to working up his surveys into large scale district maps [33]. His untimely death prevented the preparation of these maps, though the separate plots that he had protracted himself were used for general mapping[1]. Crawford reported in 1814 that no record of the river surveys had been preserved, but all the field books have now been located[2].

In 1811 Garstin reported that he had

ordered a Projection for a new map, to include all the corrections and discoveries lately made by the surveyors in the Ceded and Conquered Provinces, but...only one person can work on it at a time, as it will require much care and many corrections, consulting all the Field Books, and...several months must elapse before it it possible to furnish it ; all I can do to get it completed shall be done, and my best Hands employed upon it[3].

For his map projections Colebrooke used Hutton's tables [I, 248], with a slight modification which he explains in the following note to Sackville ;

A degree of Latitude upon the scale of 4 miles = 1 inch is exactly 17¼ inches, agreably to the proportion adopted by me, and which is somewhat more than the late Mr. Reuben Burrow's measurements of a degree has warranted [I, 248], though less than Dr. Hutton's medium of 69 1/15, upon which his table of degrees of longitude is calculated. The difference, however, is so trifling between the even number 69 and 69¼, that I still use the same table...without making any reduction in the miles of longitude. ...

The true figure of the earth is indeed so dubious that it is probable that much greater differences may in reality exist, of which we are not aware, or that the difference in the length of degrees of latitude and longitude, within or near the Tropics, may be less than Dr. Hutton has calculated [250][4].

The difficulties here indicated were largely met by Lambton's work in the south, and by the issue of his table for map projections [260].

The compilation of respectable maps always lagged far behind the execution of field surveys, and even as late as 1850 Waugh had to report that

there exists no map in the Surveyor General's Office containing a detailed survey of the Oudh Territory. Two or three attempts were made to get up a compilation from the route surveys that were forthcoming, but the latitudes and longitudes of some of the principal places being uncertain [I, 163], the former attempts were abandoned[5].

PUNJAB & AFGHĀNISTĀN

An account has already been given of Wilford's *Map of the Countries to the West of Delhi, as far as Cabul and Multan*, that was completed in 1804[6] [I, 234]. Further knowledge came with the Marātha War, and in 1806 Colebrooke submitted a "*Sketch of the Conquered Territories on the West of the Jumna*[7], shewing the mode of their distribution", distinguishing areas retained for the Company from those "handed over to different Native Chiefs". White's valuable surveys brought detailed information of the country between the Jumna and the Sutlej[8] [59–65], whilst a map compiled independently by Ellis in 1813, was actually copied for use in the Sikh war of 1848[9].

The most interesting map of this period is, however, the *Map of the Afghan territory and the neighbouring Countries*, compiled by Macartney when on Elphinstone's mission [65-7]. It extended from the Punjab as far west as Bukhāra on a scale of 20 miles to an inch[10]. Without any previous experience as geographer, Macartney constructed a map of a vast area which, without any claim to precision, shewed the general relative positions of every place of interest He gives the following account of his methods[11] ;

[1] MRIO. 31 (37-41) ; Misc. 7–0–1802 & 14–0–34. [2] DDn. 73–5, 79, 80. [3] B Pol C. 31–5–11 (82), & DDn. 128 (34). [4] DDn. 67 (382), 4–7–05. [5] DDn. 542 (166), 20–10–50 ; *PR.* 1851. [6] MRIO. 7 (11), 16 m. to 1 inch. [7] ib. 8 (1), 12 m. to 1 inch. [8] ib. 15 (26), 8 m. to 1 inch and others. [9] Five original protractions. ib. 8 (10–4), scale 9⅜ inches to a mile ; ib. 8 (15), SGO. fair map. [10] MRIO. 111 (2). [11] Memoir, DDn. 89, and IO Maps. MS. 473 (2).

Memoir of a Map of the Punjab and Countries to the Westward of the Indus, extending from the 23rd to the 41st degrees of North Latitude, and from the 60th to the 78th degrees of East Longitude, constructed chiefly from information collected during the March of the Cabul Embassy in 1809. ...

In the construction of the map particular attention was paid to obtain the correct distance of some grand points fixed by observation, ... and the spaces contained...have been filled up as much as possible by cross routes, which give the great bends of the road, and of course the position of these points, more correct than by setting off the gross distances.

The windings of the road cannot be laid down with any degree of certainty from the direction given by the natives ; I have therefore attended chiefly to cross routes forming great angles to obtain the true bearings of the road.

The first grand point...was Bukkhur[1], situated on an Island formed by the river Indus in Latitude 27° 30′ N., Longitude 69° 20′ 0″ E. ...

The 2nd grand point...was Cabul ; I have good reasons for placing this a very little north of Peshawar, first from the bearings with the theodolite from Peshawar of Suffaid Koh[2], ... and...I have 3 routes from Kogoolwata, 2 from Dera Ismail Khan, 2 from Kohat, and many from Peshawar, all of which meet at Cabul. ...

In the printed maps Cabul[3] is put N. of Peshawar, but it is evident the mistake has arisen in placing Peshawar above a degree too far to the south [I, 148–9]. Its latitude is 34° 9′ 30″. The distance from Peshawar to Attock in king's coss is 30, and by the Perambulator it was 45 M. 1 fur. ; from this I have calculated the distance from Peshawar to Cabul, and have allowed one in 8 for winding, in consequence of the road being through a very hilly country all the way.

The 3rd point is Kandahar. This I have fixed from the following routes. 4 from Bukkhur ; ... 2 from Dera Ghazi Khan. ... The distance from Cabul to Candahar is set off at $1\frac{1}{2}$ miles to each coss, being the king's road.

In this way he analysed the data collected, and carried his map west and north. Elphinstone published a reduction in his *Account of the Kingdom of Caubul*. Macartney says that though in his original map he spelt the names "as near as possible to the pronunciation of the Natives" yet "at the request of Mr. Elphinstone I made out a fresh copy, and have adopted Lieutenant Gilchrist's Orthography"[4].

Alexander Burnes, who travelled through Afghānistān and Turkestān during 1832–4, made the position of Bukhāra to be 39° 43′ 41″ N., 64° 55′ E., whereas Macartney had made it 39° 45′ N., 69° 10′ E., the true position being 39° 47′ N., 64° 25′ E., leaving Macartney sadly out in longitude. Burnes also challenges Macartney's estimate that camels could move at a rate of $2\frac{1}{2}$ to $2\frac{3}{4}$ miles an hour. His own estimate was 2 miles 300 yards per hour.

CALCUTTA DRAWING OFFICE

The Surveyor General's staff of draughtsmen at Calcutta[5] was never sufficient for the maps to be drawn. Colebrooke was just as enthusiastic a draughtsman as he was surveyor, and maintained work at high pressure on a number of general maps [268-9, 279].

Fair copies of all surveys and maps had to be made for the Directors in London, and special copies and compilations for the Governor General, the Commander-in-Chief, and for such officers as occasion demanded [23], whilst it was often necessary to furnish surveyors with copies of earlier maps of the areas in which they were working [35–6].

Writing to the Commander-in-Chief on the subject of Wood's survey in Oudh, the Surveyor General promi ed to

supply three sets of copies of each route, one to be laid before Government, one before the

[1] near Sukkur, 40 A/14, *Imp Gaz.* IX (46–7). [2] Highest point 15,620 ft. ; NW. of Pārachinār, 38 K/1. [3] Kābul, 34° 32′ N. ; 69° 11′ E. ; Peshāwar, 34° 0′ N. ; 71° 33′ E. [4] obviously Dr. Wm. Gilchrist [I, 249–50, 337] ; from Macartney, 13–4–10 ; DDn. 82 (159). Macartney's map is unfortunate in shewing the Sind R. of Kashmir as continuous with the Drās R. of Ladākh, from the Indus to the Wular Lake, regardless of the Zoji La, 11,578 ft. [5] monthly charge limited to Rs. 600 in 1788 [I, 236].

Commander-in-Chief, and one to be lodged with the General or other officer commanding at the field stations; and finally, when the whole should be completed, he would furnish copies of the general plan as above mentioned. ... The Surveyor General would likewise reduce the several plans and insert them in a new general map of the Upper Provinces[1].

There were no facilities for printing maps in India, and indeed the Directors were strongly opposed to all this copying. They had refused Colebrooke's proposal of 1796 for the publication of Rennell's 5-mile provincial maps [I, 231], and the only large-scale maps they allowed to be printed were marine charts. Even these could not be engraved in India, and the Surveyor General writes, of a chart of the Bass Straits[2];

As the expence of engraving in Bengal is considerable, and there is not...at present any Artist in Calcutta who is properly qualified for engraving Maps, it would, I presume, be more eligible to transmit the chart in question to England for that purpose, and any number of copies...in the meantime can...be furnished in Manuscript from my Office[3].

He made repeated requests for the increase of his drawing establishment and its accommodation. He wrote in 1803 that

The additional works now in hand, the principal of which are the General Chart of the Sunderbunds and Salt Agency Districts [13–4], and the New Maps of the Ceded Districts, will require some further accommodation, ... as...the additional Assistants employed on these Charts should work at the office under my own Inspection. ...

[A note in Colebrooke's handwriting]— No answer to this Letter was ever received, and the Maps alluded to were discontinued; but for want chiefly of an Assistant properly qualified to assist in the construction of them, as the Draftsmen were found incapable of doing it[4].

A few months later he writes to Crawford;

Some time ago I was directed to prepare a set of maps of the Ceded Districts, and an allowance of Rs. 300 S. Rs. per month was allowed me for such additional assistance (there being no regular assistant in the office) as I might require. ...

I have procured accordingly the help of a very able draftsman[5], in addition to those who are on the establishment ; ... but as these people are totally ignorant of everything besides mere drawing, you may easily conceive that I do not allow them to attempt...putting...of my maps together, but merely employ them to finish a bit here and there, and to put in the writing.

As I only pay this extra assistant 150 Rs., the remainder...must be satisfactorily accounted for, and vouchers produced for the disbursement of the whole sum. I have consequently 150 Rs. per mensem at my disposal, which I propose to lay out in procuring the best itineraries of such roads in the Ceded Districts as have not been regularly surveyed, and which...will enable me, I hope, to complete the maps[6].

He continued to press for an officer assistant, an Engineer for preference, but the Marātha war made this impossible, and about this time the last of the French draughtsmen retired;

Mr. J. B. Boisseau[7], who has served many years in this office as a draftsman...is afflicted with a weakness in his eyes, and other complaints, which...will render him totally unfit for the employment of a draftsman in future[8].

When Colebrooke went up country in 1807 he left the office under charge of Garstin, then on engineer duty at Fort William, who was overwhelmed with demands for maps;

Colonel Colebrooke has left but one draftsman here[9]; the rest have accompanied him. From the very little employment that has for several years past been given to people in this line, they are difficult to be procured, but for the sum of two hundred and fifty rupees per mensem, I can engage two men who will be able to finish one of these maps in about a month. ... It would on no account be advisable to permit any of the original surveys to be sent out of the office ; many of them are very valuable, and have cost very large sums in comparison to which the expence of the copying will be trifling[10].

He was allowed two draughtsmen on Rs. 150 a month each, besides a writer on Rs. 40[11], but after Colebrooke's death he writes of

[1] DDn. 67 (52), 23–6–01. [2] separating Tasmania from Australia. [3] BPC. 10–6–02 (42). [4] DDn. 67 (219), 10–6–03. [5] probably Nicholls [*inf.* n.9]. [6] DDn. 67 (489), 15–2–04. [7] Brother to André Hemmonneau [I, 236, 237]; worked since age of 16 under CE. Madras and SG. Calcutta. [8] DDn. 67 (337), 1–9–04. [9] C.G. Nicholls [17 ; pl. 4]. [10] DDn. 47 (479), 28–9–07. [11] BMC. 27–6–08 (108).

a great press of business, few people allowed to do the work, and papers are in the utmost confusion. Mr. A—wrote to me on the subject of a Draftsman. I do not believe it possible to procure one in Calcutta, but the late General Martine [I, 353-4] used to employ men of this description at Lucknow ; as did a Doctor Bruce[1], and also Colonel Hardwicke [I, 338] at Cawnpoor ; some of them are probably alive and might easily be taught to be useful. We are greatly distrest for want of such men, and their scarcity renders those we have idle and impertinent[2].

Garstin writes in 1809 ;

From the Great number of maps, surveys, etc., that have been copied and furnished...it will appear that the persons employed on it have been very diligent ; but a long arrear of business yet remains to be brought up, as there is an immense mass of very valuable materials, collected during the period the late Lt. Colonel Colebrooke held the office, ... which has been gradually accumulated ever since the assistants were struck off [I, 271 ; II, 309][3]. ...

A very considerable number of Routes and Field Books have been brought to it in consequence of the orders of the 12th of January 1804 [197] ; which have not yet been protracted or laid down. ...

Several large maps are now in hand, ... but it will require great exertion to bring the business of the office to the usual routine...by employing the extra Draftsmen and writers, ... and most assuredly not without the greatest attention being paid to keep them very close to their work[4].

The next year brought a similar tale ;

There have...been forty-seven maps copied and constructed, ... many of which were large and full of close printing, particularly those of Bundlecund. The final survey of that province is now ready for transmission to the Hon'ble the Court of Directors, and will be sent in as soon as the printing...can be completed, which will require at least two months more close application ; the outline being only half of the labour on a map, and fatiguing to the eyes.

Although the Draughtsmen and writers have been very diligent, yet but little progress has been made in reducing the great mass of materials collected by my predecessor, owing to the many pressing demands for immediate use, and to the fresh supplies of materials constantly coming in from the increased number of surveyors employed, who all appear to be diligent. ... They furnish full employment for all the draughtsmen I am able to procure, who work for as many hours every day as their eyes will allow them, beyond the usual hours of office, receiving an adequate compensation for their labour[5].

1811 brought a more cheerful report ;

The routes this year being much fewer in numbers than in former seasons, have admitted the making a tolerable advancement in the arrangement of the Voluminous mass of papers collected in the office[6].

In 1813 the Surveyor General recruited fresh blood ;

The great difficulty, or rather impossibility, of supplying the place of the European Draughtsman in this Office, either from Calcutta, or even from Madras (should any accident happen to Mr. Nicholls, or should his Eyes become worse), induces me to apply to Government for an Apprentice from the Orphan School[7], [and he was authorized] to select a boy from the Kidderpore school, to be bound apprentice...for the period of five years, upon a salary of sixty sonaut Rupees per mensem.

Andrew Macpherson[8] was appointed, though not from "the Seminary of Kidderpore", and did useful work for many years[9]. Nicholls retired in 1815 with a pension.

In their instructions of 1814 for the establishment of a single Surveyor General of India, the Directors laid down that one of his principal duties was to be the compilation of detailed large scale maps, and their reduction to a general map of India, regular copies of both being sent to England. Crawford was appalled at the magnitude of the task ;

On an inspection of the maps, ... they turn out to be twentynine in number, and laid down in 22,304 square feet of paper. To copy these productions, ... the work of many hands, would require more than ten times the quantity of drawing paper than now is in the office, and money at present cannot procure more [227].

[1] Possibly Charles Key Bruce, in Bengal 1788–1817. [2] to Webb, DDn. 81 (40), 7–11–08. [3] ib. (95), 113–5–09. [4] ib. (95), 28–7–09 ; BMC. 5–8–09 (91). [5] DDn. 126 (3) 24–4–10. [6] DDn. 128 (11), 2–4–11. [7] DDn. 138 (160), 17–9–13. [8] Later called J. A. Macpherson, BTC. 22–5–23 (55). [9] BMC. 18–9–13 (118) & 2–10–13 (96).

Such is the quantity and press of business at present, that I would most willingly hire extra people at my own expence, ... but I have in vain tried to procure anyone who can be of use. ... At present I have in hand the large map of Bundlecund by Lieut. Sackville [48–9], and, ... for the use of the Resident at Poonah, a very large map now compiling by myself ; ... besides these, I have very lately received orders from...the Commander-in-Chief[1] to copy and send up no less than eight maps, one of which contains the dominions of Holkar, Scindia, and the Berar Raja ; another of these I am ordered to compile from the papers sent round from Madras and Bombay ; added to the documents that may be found in this office, this will extend from the Hurdwar to the Nizam's frontier, and from Chitagong to the Great Desert.

I have had a good deal of work of the kind...pass through my hands before I was Surveyor General, yet never...could ever make it correct or to be depended upon ; this arises from the general contradictory, unsatisfactory, and incorrect, mode of laying down work. In some of these maps, for instance, I have observed some rivers running across each other, and in others...where the innumerable rivulets are laid down in...an infinite number of squares upon the map.

Were I even permitted an increase to the establishment for the translation of the names, still it would take up my own time in compilation...(having no assistant), and the time of every one of the Draughtsmen...to print the great number of names of villages, etc., for several months.

Notwithstanding these observations, ... should it still be the wish of Government to have these maps reduced, and afterwards consolidated in one general one, they shall be put in hand ...as soon as my present demands have been compiled with, and proceeded on as fast as paper can be procured, ... to the best of my ability[2].

At the end of 1814 the regulations for the office were ;

The sum of 784, as by Regulations [of 1788][3], is appointed to defray the expense of the Establishment, but, as that is not found sufficient, there is a further sum of 340 allowed for Extra people [272], as there is more work required from our late conquests and acquisitions. ... The selection and choosing the Draughtsmen and copiers is entirely left with the Surveyor General, and they are not looked upon...as public servants. ...

Drawing paper, stationery, Instruments, Colours, &c., are drawn for in a Contingent Bill once a year[4].

In spite, however, of this heavy work at headquarters, ready help was given to the field surveyors, either in the way of embellishing a poorly drawn map with handsome lettering [76], or by giving practical assistance such as called for by Fleming [18] ;

My Dear Charles, Not being able, even with your kind asstce., to Procure the Proper kind of Paper for our Survey, and neither Schalch or I being expert at joining smaller sheets in a handsome way, ... will [you] assist me by suffering one of your people to join and send me up some. Our Plan is *only* 12 feet long and 6 feet broad, done on a scale of 9 inches to a Mile[5].

MADRAS

In Madras responsibility for general maps, as distinct from surveys, rested with the Chief Engineer until 1804, though all surveyors held jealously, so far as they could, to the maps they prepared from their own surveys. Thus the Captain of Guides held charge of all maps prepared from his military route surveys ; Mackenzie held to himself all the maps he made of the Nizām's Territories and of Mysore. Goldingham held all maps required for the Revenue Board.

In 1803 the Chief Engineer compiled a map of the

Peninsula of India, from the 20th degree of north latitude to Cape Comorin, shewing the possessions and colonies which belonged to the Governments of France and Holland at the Commencement of the late war. Scale 20 miles to 1 inch. Coloured. Shows all district boundaries and names[6].

This is possibly "a map for the use of the Post Office", for which the Chief Engineer asked that Goldingham should " assist me with such...Geographical

[1] Lord Moira, also GG. [2] DDn. 143 (115), 23–1–15. [3] Office rent, Rs. 90 ; writer, 50 ; followers, 44 ; draughtsmen, 600 [I, 236, 262, 290]. [4] from SG. Bengal to Mackenzie, 6–1–15 ; DDn. 131 (114); *Carroll's Code* (44, 45). [5] Berhampore, 6–5–14 ; DDn. 136. [6] MRO. Map 11 ; MRIO. 145 (4), scale 27 m. to inch.

information he may have in his possession"[1]. Goldingham certainly had more material at his disposal than the Chief Engineer, and by 1803 had completed a *Map shewing the countries under Fort St. George, divided into Circuits & Zillahs*[2] for which Mackenzie had grudgingly passed him a "reduced copy of the Outward Boundary of Mysore".

For two years from 1804 the Astronomer was made fully responsible for maps [290], and Warren took the opportunity to prepare a *General Map of the Peninsula of India*, which was acknowledged "as a creditable specimen of the abilities of the boys attached to the Surveying School"[3].

Before the start of the Mysore survey, Warren had compiled a map covering "the Mysore territories and neighbouring countries"[4], which shows the march of the Grand Army under Harris [233] and routes of Colonel Close and of the Governor's wife, Lady Clive. The descriptive memoir is dated 6th April 1800;

The map constructed from Lieut. Emmitt's Survey (which is the only actual one we have of those parts) [I, 130] has also been consulted to ascertain the course of the Toombudra River [94–5], and the position of Anagoondy, Honelly, and other places. ... The country about Panganore[5] in particular is scarcely known at all by any one of the people with whom I have conversed. ...

When I first began to investigate that remote part of Mysore, I found an immense unexplored tract before me, the most general outlines of which are even now unknown to our best Geographers. Goodicotta [pl. 11], the head Cusbah of a district of some extent, ... is not mentioned in any of the maps which I have yet met with. From the Revenue servants employed in that quarter, no distinct information could be procured, and it was not without some difficulty that even among the Hircarrahs...any one of them could be found that has visited that part of the country[6].

As the survey progressed, Mackenzie classed his maps under two heads;

1st. Those of the surveys committed immediately to my charge, ... into which nothing is introduced but what is actually surveyed by myself or my assistants.

2nd. The other comprehensive general and particular maps which...have been required from me, and which are compiled from such authorities as can be procured, particularly those done at the expense of Government. ... In such cases the authorities are always given.

I find it necessary to make this distinction, because there are people here ill-informed enough to believe that in my plan of survey the work of others may be used, which I have ever carefully avoided, excepting in compilations of general nature, where they are always noticed[7].

The maps covering his first three years work in Mysore were submitted in 1803 [103] and the full results in 1807 and 1808 [111–12; pl. 11]. The general maps of the Ceded Districts survey were not completed till after Mackenzie's return from Java.

He was not interested in preparing general geograpical maps of the peninsula, and considered this a task to be left rather to cartographers such as Arrowsmith. He kept his own staff fully at work on mapping his own surveys.

From 1806 to 1810 responsibility for maps rested with the Quartermaster General[8], who was particularly interested, not only in general maps for military purposes, but also in mapping the surveys of the Military Institution. He had organized a drawing office of his own, and was most reluctant to close it down when Mackenzie was appointed Surveyor General;

Lieutenant Kinsey was appointed to the particular duty of arranging and registering the ...Materials collected by the Institution since the Commencement of their survey [129]. ... If these Topographical Materials, which have been particularly collected for Military purposes, shall be taken from the Quartermaster General's office, their loss will be deplored, as it will be impossible to copy them, whilst they can be of but inconsiderable use to general geography.

The Arrangement of these materials was but an inferior part of the duty conducted by Lieutenant Kinsey; for he was likewise employed in separating and comparing the various Geographical materials which had been received, ... and a General Atlas of the Peninsula had been commenced[9].

[1] MPC. 12–10–02. [2] MRIO. M. 145 (1) sd. by Goldingham, 1–8–03. [3] MPC. 8–4–08. [4] ib. 135 (30). [5] Punganuru 57 K/11. [6] HMS. 460 (69), 6–4–00. [7] to Lambton, DDn. 66, 7–6–04. [8] Valentine Blacker; QMG. Madras from 1810; SG. of India, 1823–6. [9] from QMG. 3–11–10; MMC. 29–1–11.

Government ruled
the appointment of Lieutenant Kinsey...unnecessary. ... It has been deemed advisable to limit as much as possible the surveying department in the Quarter Master General's office. One or two Draftsmen at most are...sufficient for copying the routes and such particular information as may be required for the use of that office[1].

Mackenzie was most insistent that the Quartermaster General should not maintain a rival drawing office to his own [301];

The Quartermaster General complains of inconvenience arising to his duty; but I... submit...inconveniences which must arise in this Office...if any of the Geographical or Topographical maps of this Presidency are to be retained, or called for at pleasure, for the purpose of being copied or inserted into such general preparations. ... By these preparations I understand a general atlas on an extensive scale, ... which...is...contrary to the spirit and orders of Government and the Court of Directors. ... The first idea of a general atlas of this kind at this Presidency, so far as I know, originated with myself, and was suggested in my letter of 18th October 1808 [102, 112].

This suggestion, made when submitting his final maps of Mysore, had been rejected by the Directors[2]. Mackenzie went on to urge
that any Geographical compilation of this extensive nature properly forms a material object of the Surveyor General's Department, and will require particular discrimination of its materials and construction, and a clear knowledge of the authorities ... To place...the condensed results of the whole detailed surveys in the sole possession of another office would defeat the declared object of Government, and reduce the Surveyor General's office to a mere repository of the mutilated and worn-out papers which have already been used in other Offices[3].

Amongst the maps under dispute was one compiled by De Havilland who had written;

During the time of my being employed with the Hyderabad force, in the hope of my appointment being extended to the whole of the Deckan [280], I collected a large quantity of Maps, sketches, and other documents and materials for the construction of a General Map, at a very great labour; and I afterwards began, and advanced, the compilation of a general map on a large scale[4].

Mackenzie records that this map, which
appears to be still unfinished, consists of 6 sections, containing each of them from 5 to 3 sheets, and appearing...to consist of a compilation on a large scale of the surveys carried on for several years back, not only in the Deckan, but thro' Mysore and Malabar, as far south as the parallels of Chitwa, Tanjore, etc., and which I presume was intended to include the Southern Provinces and ultimately the whole of the Deckan in its most extended view[5].

Morison, who now took over from Mackenzie [299], agreed that De Havilland's map should remain with the Surveyor General, and
that to transfer it back to the Quarter Master General would be to involve on this department an incalculable degree of trouble in preparing from old materials a compilation which has already been formed. ...

There can, however, be no question on the propriety, nay the necessity, of the Quartermaster General being possessed of a General Military Map of the countries which are occupied by the Madras Army, as well as of those countries in which the army may be likely to act, but...a military map on a scale much less extended. ...

It will of course be one of the primary duties of this Office to construct a General Map of the Peninsula, ... and a copy of such a map...would doubtless be of material use to the Quartermaster General[6].

Government agreed and ordered the preparation of a general map, besides maps of the three military divisions on scale 8 miles to an inch[7]. These latter were delivered to the Council by the end of 1814, and Blacker immediately demanded copies for the Quartermaster General[8]. Morison's reply was unhelpful;

A General Map of the Peninsula was commenced on...the orders of Government. ... It has been completed as far as I had authentic surveys to insert in it, and it's progress on the same principles will proceed as fast as further surveys are finished. To introduce vague and

[1] MMC. 29–1–11. [2] CD to M. 9–2–10 (2–4); DDn. 43 (259). [3] MMC. 2–4–11, from SG. 29–3–11 (12). [4] ib. 4–5–10. [5] ib. 2–4–11 MRO. map 569; *General Map of India*, 5 Sections, one missing. [6] ib. 14–5–11. MRIO. 97 (8), Map of Hindoostan N. of 21°; 12 m. to inch; Madras, 1814, bears Morison's initials. [7] ib. 10–3–12, MRIO. 133 (32); 135 (32); 136 (8). [8] DDn. 142 (19), 20–3–15.

uncertain information in filling up the existing blanks would, ... destroy the character of the whole work. ...

The maps of the divisions, not being of the same general nature, were completed with the best materials that have been collected, ... and although a considerable part, ... with the exception of Mysore and the Ceded Districts, is not altogether to be depended upon, they will, I believe, be found to answer the objects for which they were intended.

The time at which you may...receive an authentic general map of the Peninsula will depend upon the progress...in surveying the countries which are still unsurveyed, and, with respect to...copies of the Division Maps, ... should the Government direct the preparation of them, they will of course be furnished to you[1] [160, 292–3].

Lambton's general map of the *Southern Provinces of the Peninsula*, 8 miles to an inch, submitted in December 1810 [244, pl. 17], was the first geographical map of any part of India to be based on scientific triangulation. It is a very clear and well-balanced map as regards physical features and place names, but shows no adminstrative partitions or boundaries[2]. His views about other maps, written about two years later, are worthy of record ;

It is not my intention here to animadvert on the geography of the peninsula as we have had it handed to us in the printed maps. These, it is true, are erroneous, but, when we consider the materials from which they have been compiled, and the total impossibility of procuring better, we must allow that great credit is due to those gentlemen who have had the perseverance and industry to compile them. ...

I only hope that the next maps of the Peninsula...should be constructed from other materials besides...military marches and perambulators. These may do in the hands of a Quarter-Master General, who wants the actual distances that troops have to march, and not the distances reduced to chords of arcs ; nor does it matter to him whether the armies march on the surface of a spheroid or of a sphere, or on the flat. But, when such materials are intended for geographical purposes, it becomes necessary to have the outlines, at least, of a general map on correct principles, so that the distances, however crooked or winding, may be adjusted and fitted to those laid down with accuracy. Under these limitations the materials furnished from military marches may be eminently useful[3].

MADRAS DISTRICT MAPS

It was one of the duties of the Inspector of Revenue Surveys [I, 285, II, 139, 150] to prepare all maps wanted by the Revenue Board and, before going on furlough, Goldingham sent in,

part of those I am now preparing ; ... the whole will be reduced to the same convenient scale, and bound up together with such further information respecting the Revenue, Population, Extent, &c., as may be useful.

I had in view, after these Maps were completed, the construction of a set on the same scale shewing each Zillah upon a separate Map ; ... also a separate Map of each Circuit ; but, being under the necessity of going home for a time on account of my health, I shall not be able to complete this useful work[4].

The Board acknowledged them as being "executed in a style of superior neatness", and promised "to forward them to His Lordship's inspection"[5].

Besides preparing district maps from the work of the assistant revenue surveyors [150], Warren compiled general maps of the peninsula for the Revenue and Judicial Departments, and for the "Court of Suddur Adawlat", shewing district and collectorate boundaries so far as they could be ascertained[6].

After the formation of the Surveyor General's office, regular district maps, tied down to Lambton's triangulation, were prepared under Ward's supervision for Tanjore, Trichinopoly, Coimbatore, Madura, Tinnevelly, Rāmnād, Sivaganga, and Tondiman's Country ; all on the scale of 4 miles to an inch [150–1][7].

[1] DDn. 142 (22), 31–3–15. [2] MRIO. 145 (19), sd. by Peter Lawrence ; ib. (21, 22), SGO. copies by Macpherson and Gould ; pl. 17 is taken from 145 (20), a 24 m. reduction. [3] Bellary, 17–11–12 ; *As R.* XII, 1818 (294). [4] M Rev Bd. 6–12–04. [5] ib., 31–12–04. [6] MRC. 14–3 & 11–4–10. [7] *IO Cat.* & MPC. 19–5–12.

MADRAS DRAWING OFFICE

Before he left for Mysore Mackenzie had obtained a store room in Fort St. George for his maps and charts, but on his return he had to make other arrangements, and pointed out

the necessity of assigning some rooms for the preservation of the papers and charts of these surveys, as I had suggested and obtained in 1799 ; but their removal in consequence of the new arrangements of Quarters in the Fort having exposed them to damage in my absence, since my arrival here, for their security and readier access & for the convenience of having the establishment under my immediate inspection, I hired a house. ... But, as the geographical materials would be exposed to risque in carriage over the country, or in damp godowns here in my absence, I hope some room may be now conveniently assigned for their preservation...as a Geographic Depot, being in fact inclusive of materials extensively connected with the Geography of the Country in General, as well as that of Mysore, which is continually increasing[1].

At the close of the Mysore survey in 1807 he wrote again ;

The rooms which are at present occupied by me in the Fort Square, being in every way inadequate for the accommodation of my establishment and of the records relating to the Survey, I hope that there will be no impropriety in requesting...a suitable office, or office rent, for the short period that may be further required for the termination of my labours[2].

He was thereupon granted an allowance from the Board of Trade for the hire of a house as residence and office.

From 1808 to, whilst occupied in geographical, historical, and archæological, research, and holding the sinecure post of Barrackmaster, Mysore, he was allowed rooms in the Fort. Most of his surveyors were sent up the Ceded Districts, and a few draughtsmen were engaged. He writes to Hamilton in the Ceded Districts ;

Lantwar's ill-health...renders it necessary for him to leave the Survey for a time, & I have also occasion for him here soon. Newman is directed to join you, and you will give him such instruction...in surveying, with the intention...of qualifying him better as a Draughtsman. ... You will employ him...both in Surveying & Drawing, & if he follows your own stile in the latter I shall be well pleased.

A Draftsman has been shewn to me who has been some time at the Revenue Surveying School. I had some thoughts of employing him, but as you may know something of his ability for Drawing I will thank you to acquaint me. His name is Pereira[3], & as he must have attended the School while you were there from 1807 to 1810, I wish to have your opinion.

In July 1810, being called on to "furnish the Quarter Master General with a catalogue of all the geographical materials in my possession of a military nature", [291] Mackenzie asked

that necessary time be allowed me for the purpose, as the accumulation of the materials of the Mysore Survey, ... in consequence of their sudden removal in December last from the office assigned me in the Fort, and the intermixture that took place in consequence of being crowded into rooms little adapted for a proper arrangement, ... has put it out of my power to comply with the several orders I have received since 12th December[4].

Later, after appointment as Surveyor General ;

I removed the public papers, documents, and instruments, of the Mysore and other surveys under my charge before the 1st January last to the house I then occupied. ... The rooms then pointed out to me were unfit for the purpose of placing them in safety, and of employing the establishment of writers and draftsmen with any convenience. ...

In consequence of the former rooms in the Fort being occupied by me, the office rent recommended by the Board, of Pagds., 45 per m., of August 1807, had ceased to be drawn, and as since 31st December last I have been obliged...to make use of the greatest part of the house I lately occupied, together with tents, as an office, ... I hope...that a proportionate office rent be allowed me[5].

On this, he was allowed to draw 45 pagodas a month for giving up part of his residence to the office[6] till his departure to Java [303].

[1] DDn. 41, 13–7–03. [2] DDn. 43, 13–7–07. [3] John Victorino Pereira [I, 284 ; II, 343] DDn. 83, 18–12–10. [4] to Mil. Sec., 11–7–10 ; DDn. 83 (66). [5] to Bd. of Trade, 29–11–10 ; DDn. 83. [6] MPC. 11–12–10.

The Deccan, or country of the south, covers the area contained between the Narbada and Kistna rivers and the Eastern and Western Ghāts. In 1800 the northern areas were under the rule of the Marātha Rāja of Nāgpur[1], the western area under the Marātha Peshwa of Poona [49 n.2], and the remainder under the *muslim* prince, the Nizām of Hyderābād.

Such little knowledge as was available of the geography of this vast central upland was contained in Mackenzie's map of the Nizām's Dominions [I, 245], and Reynold's *Map of Hindustaun* that was still in the making [282]. Rennell's earlier *Map of Hindoostan* gave but the vaguest information.

The war against the Marātha Confederacy that opened in 1803 [1, 57] at once attracted attention to their country, and a map was published in London entitled ;

Seat of the Mahratta War. A Map of the Mahratta Country, the Country of the Nizam, also of the Nabob of Oude, together with the British Possessions in the India North of the River Krishna. ... Founded on the authorities of Rennell, Don, etc; ... the author trusts that from the Emendations he has made, the geography of this highly interesting region will be as easy to be understood as that of England[2].

On a call from the Supreme Government, Reynolds prepared a *Map covering part of the Deccan*, scale 8 miles to an inch, showing an area from Baroda to Poona and eastward to Burhānpur ; it contains notes on battles fought and the marches of troops during 1803[3]. This information was later improved upon by Johnson's map which incorporated the knowledge gained during Wellesley's compaigns, and was put together on the spot [165].

Meanwhile Colebrooke reported from Calcutta

considerable progress in a new general map of Hindoostan and the Dukhan, extending from latitude 12° to 30° North, and from Longitude 72° to 89° East, which will include all that is hitherto known of the Mahratta States[4].

A year later this map,

which I reported...last year as being in some forwardness, has since...been considerably improved by a survey of the Hon'ble Major General Wellesley's Marches, and other materials lately procured, but such is the laborious nature of the work (to which, owing to numerous official duties, I am unable to give all the time I could wish) that it is yet far from being completed [134]. A reduced copy of this map, to contain the Seat of the late and present war with the Mahrattas, is likewise in hand[5].

It was not until August 1806, after peace had been signed, that he submitted this *Map of the Seat of the late War in Hindoostan and the Duckin*, stretching "from Hardwar to Seringapatam, etc., on a scale of $4\frac{1}{4}$ inches to a degree", and comprising "nearly the whole of my geographical labours since the commencement of the late war" [268–9][6] ;

I beg leave to apologise for the length of time which has elapsed since this Map was first begun, and for the delay which has unavoidably occurred in finishing the copy.

It was intended at first merely to contain the Seat of the late War with the Mahratta Powers, but I found it necessary afterwards to include a much larger extent of Country, as well with a view to its affording the greater information, as to exhibit the New Possessions of the British Nation in India. The Province of Cuttack, in particular, has been inserted from the late Surveys, and the Country to the Westward of Delhi, and along the Right Bank of the Jumna, has been laid down chiefly from Surveys taken since the commencement of the late War. ...

I have endeavoured to colour this Map so as to convey an idea of the extent and boundaries of the several States, but in doing this I have not been so particular as I could have wished for want of the necessary information ; for instance, the Countries belonging, or paying tribute, to Dowlat Rao Scindia, to Holkar, and the Peishwa, on the North of the Taptee and Nurbudda Rivers, are so intermixed that I have not been able for the present to distinguish them by

[1] or Berār [23]. [2] Map by J. Luffman, 1st May 1804. BM. K 115 (27). [3] MRIO. 122 (21); In *PR.* Waugh describes another *Map of the Dukhun*, 16° to 19° N. ; 74° to 76° E, a Bombay office compilation. [4] DDn. 67 (305), 14–3–04. [5] ib. (363), 12–3–05. [6] ib. (499), 23–2–04 & (432), 26–3–06.

more than one colour, ... and the several petty Rajahships which intervene between Bengal, Orissa, and Berar, I have from a want of knowledge of their respective boundaries denoted by dark green. ...

I am far from presuming to offer this Map as perfect of its kind, being conscious that it is still very defective, and that it will require hereafter many corrections. I entreat the Government therefore to receive it rather as a specimen of a more perfect work which I have begun, and which is intended, when finished, to include all India [281][1].

The need for such a map is illustrated by a demand made several months before its completion by Colonel Wallace, commanding the troops in Berār ;

The great want...of correct and minute geographical information respecting Malwa and the tract immediately north of the Tapti and Berar has been...an evil of considerable public importance, from depriving me of the means of recognizing the situation of places...to take the most effectual steps for the protection of the Territories of our allies the Soubah of the Deccan and Peishwa. Having, therefore, understood that Lieutenant Colonel Colebrooke ...lately compiled a map, ...which is lodge in the Engineer's office in Calcutta, and contains much useful information regarding this country, ... [I] request...a copy of this document[2].

Though Colebrooke's map was not ready, Wallace's needs were in part met by the work of De Havilland, who had joined from Madras in July 1805, and spent some months making surveys of the Berār and Khāndesh border [133–4]. The suggestion that De Havilland should be put on special duty to survey and map the whole Deccan could not be carried out, but he spent some time collecting materials, and made considerable progress in compiling the map that eventually reached the Surveyor General's office at Madras [276].

PERSIA

In 1805, whilst collecting material for maps that were to illustrate his *Treatise on the Comparative Geography of Western Asia*, Rennell made enquiries for the geographical results of Malcolm's mission to Persia of 1800–1, and it was then found that the work of Webbe and Pope who had accompanied that mission [I, 286 ; II, 173] had been put away amongst the records of the Madras Observatory without further action. At Malcolm's request Warren employed Webbe to work up these sketches and astronomical observations into a map of the route from Bushire to Tehrān, which was sent home to Rennell[3] [I, 375].

In 1808 Malcolm was again deputed on a mission to Persia and, after his abortive start [173], he employed his officers on map making [131, 174] ;

I had the highest reason to be satisfied with the great industry and science of the officers of the Military Institution of this Presidency, who, under the Superintendence of Captain Goodfellow of the Engineers, completed during my stay at Bombay a very large and valuable map of the Western Frontiers of India, Persia, and part of Arabia, Egypt, and Turkey[4].

Sir Thomas Hislop[5] noted later that a copy of this map "has by some means got into the hands of Map sellers at home, and has been published"[6].

On his return from the successful mission of 1809–10, Malcolm kept Webbe at Bombay to prepare a map embodying all the surveys made by officers of the mission through Sind, Baluchistān, Persia, and even to Baghdād [175–6].

The maps prepared by Sutherland on the Harford Jones mission during the same period were not brought back to India [176].

[1] From SG. 8–9–06 ; BMC. 6–11–06 (85). [2] to Resdt. Poona, Dec. 1805 ; DDn. 141 (161). [3] MPC. 28–2–07 & 18–7–09. [4] MGO. 26–5–09. [5] C-in-C. Madras. 1813–20. [6] Minute of 15–1–16 ; MMC. 602 (1816) 29–3–16.

CHAPTER XX

MAPS (*Continued*)

Maps of India :— Colebrooke — Reynolds — Arrowsmith. — Co-operation between Presidencies — Maps for Court of Directors — Custody & Distribution :— Bengal — Madras — Java.

AS early as 1796 Colebrooke had "made considerable progress in the construction of a new General Map of India" [I, 220 ; II, 58], for which he consulted Goldingham regarding the longitudes of Calcutta and Madras [I, 180][1].

The compilation of this map was his own personal work, and was frequently interrupted by more urgent business, such as maps of local and topical interest [268-9, 279-80], and "owing to the very laborious nature of the work, and the frequent corrections "[2], it was still in hand in 1806. After Colebrooke's death Garstin reported that

a very small progress can be made in the General Map, an undertaking which...requires great care, study and attention. The late Colonel Colebrooke...laboured so hard at this work every hour that he was not actually employed in Surveying, that he thereby shortened his life. Although he has made some progress in it, yet near two thirds of it remain unfinished. A period of three years will be the shortest that can be fixed for the completion, ... which will require much attention and hard labour out of Office Hours. ...

As my predecessor...most undoubtedly fell a Martyr to his zeal for the advancement of science, and has left behind him a Widow and nine children, scantily provided for, I...propose ...to use my best exertions at all spare times to complete the General Map begun by him, ... to have it published for the benefit of his Family[3].

He reported again ten months later

that the General Map now in hand, is, from the great extent of country comprised in it, necessarily constructed on a scale by far too small...for military purposes, being about 24 miles to an Inch[4], and containing only the cities, large towns, and principal places. It will be a... valuable addition to the public stock of Geographical knowledge, but is not sufficiently minute to become an instrument of annoyance in the hands of our enemies[5] [288-9].

The Directors refused to admit any private rights in the map[6] and Garstin had little time for such work. Crawford continued to add to it, reporting in 1814 that Colebrooke had been

employed on it for upwards of 15 years. He has now been dead for upwards of five, and two years previous to his demise he was employed as a surveyor in the Upper Provinces, so that during the last 7 years there has not been any addition made to it. Since I...came into the office I have added the Upper or Northern part ; ... this is not as yet completely filled up[7].

This is the last record of any work on the map to which the Directors refer when giving reasons for establishing one single Surveyor General of India [286–7, 306];

Subsequently to Lieut. Colonel Call's return to England, a general map of India was undertaken by the late Lieut. Colonel Colebrooke who...put together with great zeal and assiduity the best material procurable under the Bengal Presidency, and whose work of course must have superseded the map compiled by Lieut. Colonel Call. ... But although Lieut. Colonel Colebrooke's map may have been most authentic, and the best performance of his time, it cannot be doubted that it was wanting in a considerable portion of information which existed under the other Presidencies[8].

[1] DDn. 67, 5–7–1800. [2] BPC. 18–9–06 (62) & DDn. 81 (7), 25–7–06. [3] BMC. 9–1–09 (90). [4] Colebrooke in 1795 said it was commenced on scale 16 m. to an inch [I, 220]. The only map now existing that might be Colebrooke's is MRIO. 94 (46), 16 m. to inch, an unfinished paste-up of sheets west of Patna and north of Mysore, including Elphinstone's march to Peshāwar [65–6]. [5] DDn. 81 (157), 4–11–09. [6] CD to B., 9–9–12 (265). [7] DDn. 143 (22), 7–1–14. [8] CD to B., 3–6–14 (5–6).

In 1820 Mackenzie, not finding Colebrooke's map in Calcutta, asked that a copy should be sent out from England[1], but the Directors replied that

no Map of India by the late Colonel Colebrooke has been deposited in our library. Having made application to Mr. Arrowsmith [285], according to Colonel McKenzie's suggestion, we are informed that he has no such document. ...

The map alluded to, being public property, ought therefore to have been found in the Surveyor General's Office. If not there, it has probably been withdrawn by General Garstin, to whom we desire that immediate application may be made for its restoration. ... We desire that a copy of this map, in the state in which it was left by Colonel Colebrooke, may be immediately transmitted to us[2].

Blacker, who had succeeded as Surveyor General, wrongly reported that he had found the map, giving its title as *Map of the Seat of the late War in Hindostan*, which was quite another map [279]. His comments on these general maps are, however, worthy of record ;

However valuable it might have proved in 1803–4, the date to which it refers, its merits now are questionable, or at all events not to be ascertained, as there is not to be found in this office the smallest Memorandum regarding its construction. ...

A similar deficiency attends the construction of Colonel Call's and Major General Reynold's general maps, and of all maps of India, whether printed or manuscript, that I have ever heard of, since the publication of Major Rennell's Memoir [I, 214–5].

It would be idle here to enlarge on the total unworthiness of confidence, as an official document, of any map which neglects or refuses to explain its construction [I, 225][3]. These suspicions will be still further excited when gross errors are detected in the positions of important points which, being inseparable from Plans or Surveys not grounded on extensive triangulation, necessarily attach to the above-mentioned maps.

P.S....I am fully convinced that the task of making a copy of Colonel Colebrooke's Map [of the Seat of the late War] will be only so much labour mis-spent, and I am therefore disposed to recommend that the original as it stand may be sent home[4].

REYNOLDS

Reynolds's *Map of Hindustaun* was on scale 9 inches to a degree[5], and covered 36 sheets [I, 219, II, pl. 3]. Its main purpose was to cover territories outside the Company's administration, and the greater part of its material was collected by Indian surveyors sent out for the purpose. Reynolds had been working on the map single-handed since 1795, and he had to explain in 1801 that he could not progress faster owing to the lack of officer assistants, and that, though he had been offered the temporary loan of Moncrieff's services,

he may not arrive here till the middle of May, and that month will be nearly closed in all probability before we can sett seriously to work together. The rains then commence, and often, from extreme dampness, render the paper too moist to be worked on[6].

Two years later the Directors asked that work on the map

should be brought to a speedy conclusion. From Colonel Reynolds' report of the 30th March 1801 there is reason to suppose that the period of its completion cannot exceed 1802. Since the date of that report we observe that two officers, Lieutenants Drummond and Sutherland, have been appointed to his assistance[7], but as several limited periods have been assigned for the termination of the work, all of which have been exceeded, we think it proper to direct that beyond the present year 1803 no further expences be incurred[8].

Reynolds suggested that if the Directors

had an opportunity of inspecting the work itself, they would have extended a greater degree of consideration towards me, and have given me the necessary time to have perfected a work, carried on by their instructions, and with every exertion in my power. [The estimate given] ought not to have been taken up as a positive limited time ; I could only speak from conjecture ...and it was not possible for me to foresee that the country was to be overrun by hostile armies, or that it was to be affected by the scourge of famine, which makes every village

[1] DDn. 145 (33), 7–1–20. [2] CD to B., 29–10–23 (27–32). [3] Hence the History Sheets now required with all Survey of India maps. [4] DDn. 204 (87), 11–8–24. [5] 7·7 m. to an inch ; Colebrooke's and Call's being 16, and Rennell's 46½, m. to an inch. [6] DDn. 146 (49), 30–4–01. [7] Drummond, June 1801 ; Sutherland, Feb. 1802 ; Williams, Jan. 1803 [323]. [8] CD to Bo., 22–6–03 (8).

an enemy to its neighbour, and renders the situation of the traveller in the highest degree precarious, and his progress proportionately tedious[1].

It cannot be supposed that such a chaos as my materials formed, from being kept so long without assistance, could be all at once reduced to order, but every exertion has been made ...by dividing the different departments among the Gentlemen attached to me, and...if these Gentlemen are continued with me, and not called off to perform other duties, the map will be completed by the end of next year [1805]. When it is considered that the map will occupy a sheet of Nineteen or Twenty feet square [I, 219], I trust His Excellency will be convinced that nothing but the most unremitting application...could have brought so great a work in so short a time to its present forward state[2].

The Directors accepted the end of 1805 and directed that "two copies...be forwarded to us, one for the Court, and one for the Board of Commissioners for the affairs of India"[3].

In 1806 Reynolds reported that

The construction of the whole of it is now completed excepting the Punjab and a space about Kuttack, which will be left open to receive what other information I may yet be able to procure.

The construction of the Punjab and of the Country from Delhi extending to it had also been made. The fortunate return just now of some of my Native Surveyors from that Country, bringing with them the whole of the information that was required for the full development of its Geography, requires much construction necessary to introduce it. It is a matter of some importance...that this part of the Map should be rendered as perfect as possible.

He asked that copies of various surveys should be sent to him from Bengal, and concludes ;

There will still be sufficient room, I think, for the whole of the Punjab to be introduced into the fair Map before the Ships of the next season sail ; and the Hon'ble the Court of Directors shall certainly receive the Map by that opportunity[4].

The Directors accepted this further delay with forebearance ;

In his letter of the 8th August last, Colonel Reynolds attributed to his ill state of Health the delay in forwarding the Map to us, which he expected would otherwise have been sent Home in February or March of the present year, but will now only be delivered in time to be forwarded by the Ships of next Season.

We are much concerned at this further unexpected delay, and at the Cause assigned for the same ; but...we must consider it unavoidable. ... We expect that the Map, when finished, will be sent direct to the Court, and to them only[5].

At last, in January 1807, Reynolds decided that the map was sufficiently advanced to allow him to leave India, and he asked permission to carry the first copy home to the Directors himself, leaving Williams to complete copies for the Board of Control and the Supreme Government ;

A copy...for the Board of Controul can be carried into effect immediately on my departure, for...I shall be happy provided my papers are left in the hands of a person...in whom I can place the confidence that is necessary to leave every necessary document behind me, excepting the map which is now preparing for the Court of Directors, which I propose to submit to the inspection of this Government previous to my embarking. ...

The orders...which for a long period has deprived me of my extra allowances [I, 282 ; II, 325], did not...prevent me from continuing to employ my Native Surveyors. ... Several of these ...have returned, and some of their information is inserted in the map now preparing for the Court of Directors. Much remains in the journals unextracted, which shall be added to it in England, and a copy of that information sent back to this country to be lodged in my successor's office here[6].

The Governor and two of his Council inspected the famous map ;

Having this day assembled at the Surveyor General's office, and inspected Colonel Reynolds' Map : Ordered that it be noticed to the Hon'ble the Court, in communicating that Officer's return to England, that we have no doubt of this work being honored with the approbation of the Hon'ble Court of Directors, and doing credit to the ability and unwearied labour of Colonel Reynolds. ...

Neither, when the very great scope of this unparalleled undertaking is considered, need ...the time required on its completion excite surprize. The Main object for appreciation

[1] from Reynolds, 10–3–04 ; Bo PC., 23–3–04 ; DDn. 146 (59). [2] DDn. 146 (2–4), 21–5–04. [3] also called Board of Control ; appd. by British Govt.; CD to Bo. 9–10–05 (4). [4] Surat, 14–2–06 ; BMC. 20–3–06 (2). [5] CD to Bo., 6–8–06 (73–5). [6] Bombay, 11–1–07 ; Bo MC. 13–1–07.

is whether the work be well performed, as we trust will be admitted by the professional Judges, more competent...than we pretend to be ; and in that case Colonel Reynolds...will derive the... well earned reputation of exhibiting the first General Map of India, and of having achieved the most enlarged and important Geographical undertaking ever, probably, attempted by one man[1].

Reynolds did not forget that war with France extended to all the oceans, and that British ships were continually being captured on the high seas ;

The Map and other Geographical Papers now proceeding with me to England should not be allowed to fall into the hands of the Enemy, in the event of the St. Vincent being obliged to submit to a Superior Force in her voyage to England. I request you will procure for me the Hon'ble the Governor in Council's Sentiments whether, on such an event becoming unavoidable, it will not be proper for me to Sink the map and other Papers. The Original being left here with my successor, Copies could be made again here[2].

The map reached England safely and was duly presented to the Directors, who expressed their warm appreciation ;

There can be no doubt that a Map of the whole of Hindustan upon a more extended and more comprehensive scale than any that has been hitherto attempted, and from actual Survey, is...highly desirable, both in a Political and Military view, and the Map executed by Colonel Reynolds appears to be framed in this manner.

It is on a scale of Extraordinary imagination, and contains considerable more information than any work of the kind now extant, and from the Inspection that has been made of it here it is generally acknowledged...to evince the most indefatigable research in acquiring materials, and great application and ability in compiling the map[3].

After Reynolds's departure Williams, who succeeded as Surveyor General, pushed on the copy for the Board of Control [283 n.3], and in November 1807 asked for copies of the latest Madras surveys, which were tactfully refused ;

We beg to assure you of our ready disposition to meet every request, ... but there are reasons in the present case which prevent us from complying with your application.

The only surveys of the territories under this Government which, from their accuracy, ... are fit to be included in the compilation of a General Map of Hindostan, are the survey of Mysore undertaken by Major Mackenzie, and the General Survey under the Superintendence of Captain Lambton ; but, considering the extraordinary pains...bestowed in the execution of these works, and the science...displayed in them, we deem it due to Major Mackenzie and Captain Lambton that the result of their labours shall be submitted in the first instance to the Honorable Court of Directors. ...

No survey of the Districts ceded by the Nizam has yet been made, and...scarcely any authentic materials have been obtained...of that part of the Territories of Fort Saint George. ... We are unwilling, by a communication of the imperfect materials which we possess, to incur the risk of impairing the general accuracy of the map[4].

In February 1808 another map compiled from material collected by Reynolds was sent home ; "a subsidiary though useful work, ... executed by Captain Williams and Captain Sutherland, ... exhibiting the British territories subject to this Presidency"[5].

After the copy for the Board of Control had been despatched to England, twenty sheets of another copy were sent to the Supreme Government who asked for "the remaining 16 sheets still required to make up the full Map" [I, 219][6]. Apparently these remaining sheets could not be copied until, in January 1812, Webbe and Sundt [157] were attached to the Bombay office for the purpose. In 1815 Williams obtained special authority to retain these draughtsmen "on their present allowances until the Maps are completed"[7], and he set to work to revise the whole map from the latest material ;

I am under orders to complete the General Map, of which a part was sent to Calcutta for the use of the Supreme Government in February 1809, but the pressure of the other duties... has prevented my going on with it, and I had lately determined to construct from the material left in my hands by Colonel Reynolds, and the others collected by myself, a new general map of India...in place of completing [that] which would be a less perfect performance. ...

[1] Bo MC., 27–1–07. [2] ib. 13–2–07. [3] CD to Bo., 7–9–08 (9). [4] MMC. 2–1–08. [5] Bo to CD. 20–2–08. [6] B Pol C., 9–1–10 (73); 18 sheets W. of Delhi, N. of Gwalior, including index, 9 inches to degree, MRIO. 94 (23–40), pl. 3 being taken from 94 (29); see also ib. 85 (1, 7, 8). [7] BMC., 8–4–15 (7) MRIO. 123 (8) includes several revised sheets drawn by Webbe after 1814, scale 18 inches to degree.

The materials left...by General Reynolds are competent to the formation of a General Map of India on a Scale of extraordinary magnitude, such as that officer gave in to the Hon'ble the Court of Directors, but...many of them quite unintelligible to any person but myself; ... most of them are only to be selected, and much to be rejected[1]. ...

I thought it advisable to draw this map on the same scale, ... namely 9 inches to a degree, and that the execution should also be as nearly as possible...like that original. It indicates Kashmir and Comorin, North and South, and Chittagong and Karachee Bunder, East and West. The dimensions are 22 feet by 17, and to the best of my judgement it will take about 12 months to complete[2] [pl. 15].

This map was not completed until 1821, shortly before Williams retired, and it was despatched to Calcutta by ship in July[3]. Hodgson, who had just been appointed Surveyor General made the following report on it;

I have carefully examined and compared it with maps constructed from more recent and correct surveys which have, since the completion of General Reynolds' work, been carried on with accuracy and success by the officers of the three Presidencies. ...

However highly, ... General Reynolds' map was estimated thirteen years ago, it loses its value when compared with those more recently constructed and published, and will still more do so when those now compiling are completed. ... The map...is not the fruit of General Reynolds alone, but of...the officers of the three Presidencies. ...

It is composed of several sheets joined together and forming a whole of about 23 feet by 18. Its scale, which probably was intended to be 8[4], is 7.6 miles to an inch, as nearly as can be measured and estimated. This scale is inconveniently large for general purposes in a map which is not most rigidly correct and well filled up, and too small for particular purposes.

The execution of the writing and printing of the Bombay map is creditable to Mr. Webb, an assistant Surveyor of the Madras Establishment [176, 352].

Attached to his report Hodgson gave a table comparing the distances between principal places on Reynolds's map with those given by Lambton's "accurate Trigonometrical Survey"[5].

Though Reynolds's map was of little value as a general map of India, there were many portions of it that remained the best authority for many years to come, and the many separate original protractions that were preserved at Bombay[6] provided material that was of the utmost value. Of these the following appreciation was written by Jopp, Deputy Surveyor General, Bombay, in 1832;

With few exceptions all these maps are the work of Colonel C. Reynolds himself, or... improved by subsequent additions and corrections by Colonel Williams, and embrace, not only the whole of this Presidency, Cutch, and the country near the Indus, but many of the Bengal and Madras Province, the Kingdom of Oude, and Central India.

It would be arrogance in me to pass judgement on the works of so eminent a geographer as General Reynolds. A comparison of his maps with regular surveys since made best prove their value, and the wonderful accuracy of the positions of the principal places as laid down by him. Little indeed is wanting but trigonometrical points to render all his papers of the most valuable description, particularly in those parts where it may not be judged expedient to push our regular surveys[7].

ARROWSMITH[8]

The most important map published after Rennell's *Map of Hindoostan* of 1793 was Arrowsmith's *Map of Hindostan*, published in 1804, in six sheets[9] [287]. It was in considerable demand, as it was on a larger scale than Rennell's, and contained some later material, and in 1814 the Surveyor General charged for "an Engraved Copy of Arrowsmith's Map of India, purchased for the Governor General. Rs. 80"[10]. It was however far from accurate. Its view of the N.W. Himālaya was very wild; nothing like so good as Wilford's [I, 234]. White writes from Delhi in 1808;

[1] Baroche, 3–2–15; Bo MC., 3–5–15. [2] Broach, 17–4–15; B Pol. C., 23–5–15 (19). [3] DDn. 191 (345), 20–7–21 & 198 (183), 9–3–23. [4] Not so; it was intended to be 9 inches to a degree. [5] DDn. 196 (90), 18–9–21. [6] See list, Bo MC., vol. 26/1820 (136–57); pl. 15 is taken from MRIO. 124 (7), scale 12 m. to inch, reduced in 1818 from Reynolds' map. [7] DDn. 235 (20), 3–5–32. [8] Aaron Arrowsmith, senr. (1750–1823); *DNB*; started work with Faden [I, 220]; succd. by nephew John (1790–1823); *DNB*. [9] MRIO. 97 A, discoloured and illegible. [10] D.Dn. 131 (73), 22–6–14.

Arrowsmith's map, so much admired for its execution, though published as late as 1804 is, in my opinion, far inferior to Rennell's, and with respect to the country west of Delhi shamefully inaccurate[1].

A more detailed critical examination was made by Peter Grant whilst surveying Gorakhpur during 1818–9, and it is obvious that a European geographer had no chance of producing an accurate map so long as wide areas remained unsurveyed.

Thorn's Memoir of the War in India, 1803–06, published in 1818, contains an interesting map on scale about 50 miles to an inch, and Horsburgh's *East India Register and Directory* for 1813 contains a map, scale about 200 miles to an inch, specially engraved "from the latest authorities", that still shows the upper Ganges sweeping westwards through Ladākh[2].

CO-OPERATION BETWEEN PRESIDENCIES

It had long been laid down by the Directors that copies of all surveys should be sent home to them at the first opportunity, and it was only after this had been done that copies should be made for the Supreme Government [I, 250-3 ; II 271].

The Directors agreed that there might be formal exchange of geographical information between Madras and Bengal[3] [I, 254, 255-6], but definitely forbade Reynolds to incorporate the work of other surveyors into his general map [I, 218]. In spite of this Reynolds still persisted in demanding copies of Bengal surveys [I, 255] and was much aggrieved at not having been sent a copy of Blunt's survey of 1795 [I, 59–60], a survey that

had been paid for by Government, and was actually lodged as a public paper in the Surveyor General's office at Calcutta. This survey has been kept from me with the utmost perseverance ; I do not know any public reason that can be assigned for it, and, if any of private nature exist, ... it ought not to be allowed to operate to the prejudice of the public service, as the reason for which I wish to possess it is...to render my work more efficient and useful to Government. ...

It can operate in no way to the injury of Mr. Blunt. He has received his reward from Government, and the tribute of approbation from the public, in having his journal...published in the Asiatic Researches for 1800. ... The survey is already known to be Mr. Blunt's, and altho' it should be inserted in my map, ... the credit of it from its publicity must still remain his. ... It is not from any private motive that I make this request[4].

Colebrooke responded cordially ;

I do myself the pleasure of transmitting to you a Copy of Captain Blunt's Survey. ... As I am desired to transmit the accompanying Plans to you *direct*, a correspondence will now, I hope, be opened between us which may tend greatly to facilitate the completion of our respective Labours. You shall certainly have Copies of Captain Mouat's Surveys of Rohilcund. ...

You were so good as to mention also that you would send me, before you leave the Country, a Copy of your General Map, which would be a most desirable acquisition, and as it is not possible that I can leave the Country so soon as you propose doing, it is impossible that any undue advantage of the Work, in the way of Publication, could be taken. Besides, I should be particularly careful that the Government *only* should benefit by so valuable a Work.

In this case I should consider it but fair to send you, in return, a Copy of my General Map, which will include, when finished, all that *We* know of the Dekkun and Countries South of the Ganges [279][5].

From this time there was a free exchange of material between Colebrooke and Reynolds, though each persisted with his own general map of India, a duplication of effort that was the main reason for the Directors establishing a single Surveyor General for all India [281, 306][6] ;

At each of the other Presidencies there was also a Surveyor General, carrying on his separate undertaking, and pursuing his own particular geographical plan.

[1] DDn. 82 (41), 9–11–08. [2] cf. HMS. 511 (676). [3] cf. the generous views expressed by Mackenzie [I, 380]. [4] to Bo. Govt. Cambay, 15–8–03 ; Bo MC., 25–10–03. [5] DDn. 67 (499), 24–2–04. [6] See also memorandum by Lord Wm. Bentinck as GG., 1829 ; DDn. 263 (6) ; also Report by Col. Dickens, 1864. GBO Lib. MG. 5 (48).

The partiality which these officers would feel for their own performances, and the prospect which might possibly be entertained of future advantage from them, would naturally render them averse to furnish information to a rival map. We are not without experience of our own orders having failed in procuring information of this nature when we applied for it.

The consequence had been that, of the great sums bestowed, and the vast quantity of information procured in the shape of maps, plans, surveys, Routes, Itineraries and Marches, a very inadequate proportion has been arranged and digested into any one general map of India[1].

It was therefore ordered that the new Surveyor General of India should alone be responsible for assembling the surveys of all three Presidencies into one general map of India. He was

not to conduct surveys himself, but to receive and appreciate the surveys made by others, to arrange the materials existing, or which may hereafter be procured and, after selecting the best and reducing them to one uniform scale, to frame...maps of provinces or of divisions comprehending a certain extent in latitude and longitude. These to be constructed on a large scale with all practicable detail, and to be accompanied with a Memoir explaining the authorities and the construction of the work.

A general map of India to be carried on at the same time, of which the foregoing separate maps will constitute the foundation, but reduced to a scale which may confine the general map within manageable limits.

These maps from the continual acquisition of additional and more correct information will be always in a progressive state of improvement[2].

It was a long time before this policy was put into practice [9] and it was completely ignored in Bombay where Williams continued to work on Reynold's map [284–5]. Eventually the Directors transferred all responsibility for the general Atlas of India to their own geographer in London [*inf.*].

MAPS FOR THE COURT OF DIRECTORS

Though the Surveyor General sent home an annual list of the surveys he had copied for the Directors, they were continually calling impatiently for some particular survey that interested them, or for copies or even originals of all fieldbooks and journals [219–20][3]. It was one of the first duties of the new Surveyor General of India .

to furnish us with copies of them periodically by means of his draughtsmen, accompanied with a memoir or journal of his proceedings, explaining from time to time the improvements he may have been able to introduce into the maps[4] [*sup.*].

In refusing to help Williams with copies of their surveys [284], the Madras Government rightly expressed the official policy ,

that the national object of obtaining a correct knowledge of the Geography of the British Possessions in the East will be best accomplished by the Geographical materials at the three Presidencies being separately transmitted to the Honorable Court of Directors for the purpose of being formed into a general map by the Geographer of the Honorable Company[5].

The geographer favoured by the Directors at this period was Aaron Arrowsmith, who produced his first map of India in 1804 [285–6], and his second in 1816. On his death in 1823, the new Atlas of India was entrusted to John Walker.

CUSTODY & DISTRIBUTION OF MAPS ; BENGAL

Various rules were issued from time to time to prevent senior officials and military commanders taking private possession of maps and surveys prepared under their official orders at Government expense [I, 250–1, 256 ; II, 294], and to prevent such maps from being published for private profit in England. We are told that even as late as 1806 an "officer of Bengal Infantry was shipwrecked on the

[1] CD to B., 3–6–14 (8, 9). [2] ib. (19). [3] ib. 1–6–05 (32–3) & 15–12–15 (8). [4] ib. 3–6–14 (20).
[5] MMC. 2–1–08.

voyage home, losing a moderate fortune, ... and valuable plans, routes, etc., collected during a long service"[1].

Inconvenience was undoubtedly caused by the stringent rule that a field surveyor should give no copy of his work to local civil or military officers without the previous orders of Government [289]. Sackville made himself very unpopular with the military commander in Bundelkhand on this account ;

From the close pursuit, also from the route taken by the Marauders, I hope they have not done much mischief in the British Territories, but as I have not either Maps or Sketch to assist me, I must rely upon the information of my Harcarrahs [I, 95, 230 ; II, 167].

The Officer Surveying the Province does not in any degree consider himself under the control of the Officer Commanding the District. I am not therefore at liberty to apply to him for a Sketch of the Country, the obtaining of which would doubtless greatly assist me whenever occasion requires the movement of a detachment.

The Political Agent was sympathetic and helpful ;

I am in the same predicament that you are with respect to the inconvenience hourly experienced by the want of a Map of the Province. I have, however, applied both publicly and privately to the Acting Surveyor, Lieutenant Sackville, for a Copy of his Survey, which that officer has promised to supply as far as finished.

The necessity of your having the most accurate Map that is procurable is so obvious that I have no doubt but that an application to the Surveyor General would immediately procure his Order to Lieutenant Sackville to furnish you with the most complete that his materials enable him to supply.

After some delay the necessary authority was obtained, and Sackville was able to oblige[2].

Alarmed by Napoleon's threat to invade India, the Directors sent out a long series of orders during 1809 providing for the most rigid control and security of maps and surveys ;

During the Public circumstances of the present time, ... no publication of Maps of India can on any account whatever be authorized...where the Surveys have been made at the Company's Expense, and when they are represented to be a scale sufficiently large to render them useful for Military Purposes[3].

Considering it of the utmost importance that the Geographical and Topographical information regarding India...should be preserved exclusively for the benefit of the Company and the British nation, and having reason to apprehend that...many valuable surveys, plans, etc., have got into improper hands, we direct that the following regulations...be in future attended to.

The Office of the Surveyor General being at the Presidency, it does not appear necessary that Copies of Surveys...should be made for the individual use of the Members of Council, Commander-in-Chief, or any others resident at Calcutta. When such papers are required by the Governor General...or Commander-in-Chief, the Surveyor General should attend with them. If they are required to be left, they are to be secured under Lock and Key, and remain in custody of the Secretary to Government, or the Secretary to the Commander-in-Chief, who is to be responsible that no copies or extracts should be made from them ; they are to be returned with the least possible delay to the Surveyor General's Office.

When Copies of Papers are ordered by the Governor General and Council, or by the Governor General, such copies are to be made in the Surveyor General's Office only. The Surveyor General is...not to suffer any copies of Papers in his Office to be made, except those ordered by the Governor General. ...

When Copies...are ordered by Government for officers Commanding Detachments upon particular services, ... a receipt...is to be given to the Surveyor General, with a declaration that the papers will be kept secret, and no copies be taken of them. When the service is finished, they are to be returned to the Surveyor General's Office.

All Surveys, Maps, &c., now in the possession of the different Offices or Heads of Departments, should be called in forthwith, and lodged in the Surveyor General's Office, and...no copies...on any account retained. ...

We have been informed that a Survey of the Country from Persia through Kandahar, Kaubul, to Hindostan was taken on a French Agent in the Punjaub. If such paper does exist, it is very desirable that it should be forwarded to Europe. It is most likely that it will be found at your Presidency[4].

In circulating these orders to his surveyors the Surveyor General added,

[1] *EIMC.* III (2). [2] B Pol C. 19–6–07 (2). [3] CD to B. 21–4–09 (62). [4] ib. 31–5–09 ; DDn. 81 (177) ; also Ch. 65 *Carroll's Code.*

as a standing regulation, that, together with the maps, plans, and Field Books, all surveyors are to give in a declaration that they have not retained or given copies of any of the papers relating to their surveys [I, 262][1].

A subsequent order allowed the postponement of this declaration till after the completion of the survey, lest "the entire loss of the survey might be hazarded by the loss of the copy dispatched"[2] [218].

A few months later the Directors wrote again ;

It is...become an object of importance to prevent...our declared Enemies, or any individuals disaffected to our Government, from obtaining valuable information touching the Geography of British India, or any of the countries belonging to the neighbouring Princes or States of Hindostan.

With this view we, in our letter of 31st May 1809, gave you some directions. ... But as this may probably be considered by you as Extending only to original Surveys...Executed under your immediate directions, we...direct that all Copies, as well as Originals, of any Geographical or Topographical Surveys communicated from other Presidencies...be immediately... lodged in the Surveyor General's Office. ...

From the tenor of these orders it will be sufficiently understood that we attach a high responsibility to the Office of Surveyor General, not only in relation to his own conduct, but to a strict Superintendence over all persons employed in his Department[3].

These orders were firmly administered by the successive Surveyor Generals for many years. Garstin writes to White [62–4] ;

When you see Colonel Ochterlony, or write to him, be so good as to inform him I made a public application for permission to furnish him with copies of your surveys, and that now the Governor General is returned I expect it will be decided on. ... You must be careful on no account to give the smallest drawing without permission of Government. The Court of Directors have in the strongest possible terms repeated their orders on the subject[4].

and to Sackville ;

I have stood firm between you and Evil, and it was you who placed me in the gap. ... The regulations, ... in the most positive terms, forbid all surveyors from retaining in their possession any map, sketch, Field Book, or other document whatsoever, concerning any survey upon which they may have been employed. Mr. D— ought not to have applied to you for the Survey of the Bank of the Jumna, and when he did so he should have been referred to this office for it. ... Had Government adverted to the orders, in all probability they would either have reprimanded you severely, or directed your recall[5].

and to Macartney ;

I shall be very glad to have the maps you promise as soon as convenient, as it is a desideratum in Leadenhall Steet[6]. The Court of Directors seem very jealous of foreign influence, and have directed the most positive orders...to prevent any Geographical papers being kept, or given to any person whatsoever, not excepting the Governor General or Commander-in-Chief. If, therefore, you have given any copies to Mr. Elphinstone or others, it will be proper to request of him, or them, to return such papers.

I now transmit an extract of the orders, ... which have been reiterated in still stronger terms. I daresay, when they hear of these particular orders, they will deliver up any surveys they may have received[7].

and to Morrieson ;

You did right to give Colonel Martindale the papers he required. As your immediate Commanding Officer, it would have been improper to have refused, but you should apply to him for every paper he received, for neither has he, or any other person, not even the Commander-in-Chief, a right to keep possession of a single document relating to surveys. ... The orders from Home are so peremptory on that head, no one must be permitted to disobey them. You will therefore write publicly to him, and request the whole may be returned to this office[8].

In a further letter the Directors extended these precautions to "all marine and nautical surveys", that they might "be exclusively appropriated to the use and benefit of the Company and the British Nation"[9].

Crawford was much disturbed to find that White had been sending compilations of his surveys direct to the Governor General's Military Secretary, and he had the following orders issued ;

[1] DDn. 81 (182), 28–12–09. [2] DDn. 82 (51), 2–1–10. [3] CD to B. 12–10–09. [4] DDn. 126 (30), 31–5–10. [5] ib. (31), 1–6–10. [6] India House, London. [7] DDn. 126 (49), 23–6–10. [8] ib. (56), 15–7–10. [9] CD to B. 25–7–10 ; DDn. 90 (6).

Upon a Surveyor being called upon by order of the Governor General to furnish his Maps, Plans, or Routes, he is to forward them direct to His Lordship's Military or Private Secretary, as the case may be, but in all other cases a Surveyor is required to send in his Maps...direct to the Surveyor General, his immediate Commanding Officer, for the purpose, if necessary, of their being thro' him laid before Government[1].

In 1813 a classified catalogue of all maps, charts, and plans, held by the Surveyor General was distribute to all departments, with a note that,

When any of these are wanted, say for instance by a Magistrate of a District, he applies to Government, and the Chief Secretary is then requested to write to the Surveyor General, ordering such a map[2].

CUSTODY & DISTRIBUTION OF MAPS; MADRAS

For want of a Surveyor General, policy at Madras regarding custody of maps and surveys was continually changing. Responsibility first rested with the Chief Engineer [I, 256; II, 274]. In 1804 the Commander-in-Chief proposed that it should be transferred to the Quartermaster General, but Government preferred the Astronomer, or Inspector of Revenue Surveys [275], and referred the matter home. The Directors ordered transfer to the Quartermaster General, who took over charge in December 1806, only to surrender it to the Surveyor General from 1st December 1810 [299, 301].

In his minute of 1804 [123–4] the Commander-in-Chief wrote;

The principal defect is the want of a particular Office for the record of Surveys. To this want may be ascribed, in a certain measure, the imperfect state of the Geographical knowledge of the Peninsula. ... Surveys which the Individual zeal of Officers...produced, were dispersed and lost from the want of a System of regular record. Surveys of our Dominions constitute as important a part of the archives of the State as the records of past transactions, but more attention and Scientific knowledge is requisite for their arrangement. ...

There are two Offices which have occasionally been employed in the arrangement of Surveys, those of the Chief Engineer and the Quarter Master General; and the Commander-in-Chief is of the opinion...that the Office of the Quarter Master General may be established as the General repository of Geographical and Topographical surveys. ... The principal Surveyors, Majors Lambton and Mackenzie, shall continue to transmit their Proceedings to the Secretary of Government, and receive their Orders from him; their Surveys will be sent from the Secretary's Office to the Quarter Master General[3].

These proposals were referred to the Directors, together with the alternative of appointing a Surveyor General [124], and in the meantime charge of survey records was entrusted to the Astronomer as "a person conversant with that branch of the service" [275]. In their letter of 30th July 1806 the Directors once more refused to appoint a Surveyor General [I, 264], and ordered that all surveys should be placed under the Quartermaster General, on which General Cradock[4], now Commander-in-Chief, put forward the following rules;

First. That the Quarter Master General's Office shall be made the General repository of all Geographical and Topographical surveys of the territories dependant upon this Government; and that it shall be the duty of that Office to preserve these documents with the utmost care; ... to construct them into General and provincial maps, and to supply such copies...as may be required by Government or the Commander-in-Chief.

Secondly. That all maps...in any of the Public Offices...shall be furnished to the Quarter Master General, for the purpose of being transferred to his office and deposited there, or of being copied and returned.

Third. That all Officers employed upon survey shall transmit their surveys to the Quarter Master General, in order that they may be recorded in his Office, and shall obey such directions relative to their surveys as they shall receive...through...the Quarter Master General[5].

These rules were approved by the Directors except that, as regards

the second regulation, ... we think the latter part exceptionable. The multiplication of copies of works of this nature should be cautiously guarded against, for reasons too obvious to need

[1] BMC. 11–12–13 (255); DDn. 129 (117). [2] BPC. 6–8–13 (8, 26); DDn. 131 (114). [3] MMC. 14–8–04. [4] Recalled in 1807, with Bentinck, on account of Vellore mutiny. [5] MMC. 29–11–06.

pointing out. ... This has been too little attended to. You will...direct that all maps, etc., in any of the other offices be transferred exclusively to that of the Quarter Master General[1].

In this same letter the Directors insisted that Mackenzie and Lambton should be brought under the control of the Quartermaster General. They were ordered to hand over all their maps, and Mackenzie was prohibited "from retaining any copy of the materials...which are exclusively the property of the public"[2].

Five months later this policy was reversed on General Hewett's recommendation [298]; Mackenzie was appointed Surveyor General, and it was ordered that

the Quarter Master General will accordingly deliver over to the Surveyor General the whole Geographical materials specified in the General Orders of the 9th ultimo [299], in which will be included all Reports and Memoirs from the Captains of the Guides...before December 1806, and all reports on the surveys which, since that period, have been carried on under the Superintendence of the Quarter Master General [276]. ...

In like manner the Revenue Board will deliver over to the Surveyor General all Memoirs or Reports on the nature, progress, and present state, of surveys carried on under the Inspector of Revenue Surveys. ...

The materials and information connected with the Mysore Survey, and with that now carrying on in the Ceded Districts, being already in possession of Lieutenant Colonel Mackenzie, require only to be handed over to the office of the Surveyor General[3].

The following month a committee was appointed at Mackenzie's request to examine and report on all this material, and there was much discussion with the Quartermaster General, Valentine Blacker, who did his best to hold on to as much as possible [276]. Mackenzie replied with some warmth to Blacker's suggestion that he should give up all spare copies of his own surveys;

Such plans and copies as are in my possession resulting from my own labors, or from those of my friends, are well known, and have been...at the disposal of all branches of this Government, for several years past. The Report of the Committee will shortly show the number... resulting from the Mysore Survey, the undoubted property of Government, and returns will soon be made of the lesser Reductions. ...

In regard to other maps executed by me since 1784 (for to that date my signature appears in some) [I, 349], I shall...state the particular descriptions of those materials executed by me, and under what circumstances they were done; but I beg to submit...the inconvenience of calling on officers to furnish copies of sketches and plans undertaken from motives approved of at the time, and sometimes with no public expence, at the distance of from 11 to 21, and even 26, years after they were (and some of them voluntarily) executed[4].

A decision was eventually reached which Government considered satisfactory to both parties, but Blacker was somewhat aggrieved at having now to look to the Surveyor General for much that had formerly been his own responsibility.

The heavy task of making a thorough examination of all these records was not completed when Mackenzie embarked for Java [299], and he asked

that sufficient time be allowed for examining this mass of materials. ... As it has taken upwards of 3 months to transfer the documents from the Office where the individual value of each must, of course, have been known, ... time will be requisite to arrange and distinguish the contents of upwards of 1,000 different charts, received in separate parcels for 3 months past, and with little...indication of their respective uses; the authors' names, and even their scales, being sometimes wanting.

The last part of these materials, being 257 Plans from one Office, and 14 boxes and cases... from another, the Marine Department, have only been in the office since the 4th and 19th Instant, and to this moment it has been found impracticable to arrange the whole[5]. ...

Almiras[6] have been prepared for their reception and, tho' from the suddenness of my departure the arrangement of the charts I had proposed could not possibly be executed till after the inspection of the Committee, I have reason to think their security will be attended to during my absence, so as to prevent any further loss[7].

The orders of the Directors for the security of maps were strictly observed in the Madras Presidency just as in Bengal, and after examining Mackenzie's maps of Mysore, the Directors sent out further orders;

We shall wish the many materials furnished by Lt. Colonel Mackenzie to be used by our Government, and a set of his memoirs ought, with that view, to be lodged in some of the public

[1] CD to M. 9–8–09. [2] DDn. 68 (160), 6–5–10. [3] MMC. 2–11–10. [4] Letter of 19–1–11; MMC. 8–2–11. [5] Letter of 29–3–11; MMC. 2–4–11. [6] Bookshelves, or cupboards. [7] MMC. 23–4–11.

departments, particularly that of the Revenue Board, together with the sections of his map which he proposes to form into an atlas [102].

But, desirous as we are that the public at large should have the gratification, and himself the credit, which would result from a general knowledge of his work, we entertain considerable doubts of the propriety of publishing it at this time ; ... therefore no copy of his map, or the division of it, further than for the public offices just mentioned, ought to be taken[1].

Mackenzie thereupon sent out orders to his surveyors in the Ceded Districts ;

It had been always the practice, directed since the commencement of the survey of Mysore and the Ceded Districts, that no copies or extracts of any plans, or materials of the survey, should be retained or communicated without permission or order previously obtained ; and... orders have lately been sent me by Government, prohibiting any copies of materials belonging to this survey being retained, in consequence of the Hon. Court of Directors having excepted against the multiplication of maps and geographical materials[2].

So strictly was this order enforced, that when Lambton moved up to the Ceded Districts [245], reference had to be made to Government before he was able to get any sketches of triangles or of the country from Mackenzie's surveyors. It was indeed a very long time before the district Collectors could get copies of the survey, and Government replied to one request that,

tho' it might be convenient for you to possess the Maps you have described, they cannot be essential to the efficient discharge of your public functions, and that the express orders of the Court of Directors, as well as obvious reasons of policy, forbid the unnecessary multiplication of works of that nature[3].

Morison [299], hesitated to issue duplicate copies of the maps of the five military divisions[4] [160, 276–7] ;

When the orders were given for the construction of these maps, it was intended that one copy should be placed in the hands of the Officer Commanding, and another for the Department of the Quarter Master General, to be distributed to the Quarter Masters of Brigade in each Division. But, ... respecting the expediency of preventing the multiplication of copies of such geographical materials, ... the measure of furnishing Officers Commanding the Division with the maps, ... excepting temporarily when field service may be carrying on, would be at variance with this order, and the Honorable the Governor in Council may probably be of opinion that they should rather be deposited in this Office, subject to be called for by the proper authority when required in time of War. It is not for me to judge of the use of such maps to Officers Commanding Divisions...in time of peace. ...

There is...a heavy and direct responsibility attached to the Office of the Surveyor General for the prevention of documents of this nature being made public of falling into improper hands. ... Whilst these are permanently removed from the Charge of this Department, it is evident that the secrecy and responsibility of the Surveyor General must become of no avail. ...

Under the operation of the 5th Para. of the G.O. of Government dated the 9th October 1810, the Quarter Master General of the Army can, and does continually, call for any plan or survey in my charge. These may be extracted from to any extent, and their contents transferred wholly, or in part, to other preparations ; and this must also tend to render nugatory the rules for the conduct of this Department. ...

If the maps of the Divisions are not to be returned to this Office to be held in readiness until required, I have particularly to recommend that none of the blanks may be filled up except by the Surveyor General, and that no Extracts of any kind should be made from them[5].

To this Government replied ;

The Governor General entirely concurs with you in opinion with respect to the inexpediency of extending the number of copies of Geographical materials ; and considers that the custody and preparation of all information of that description should belong exclusively to your Office. It has, however, been determined...to allow one map of each of the five Military Divisions to be lodged at the Head Quarters of the Division—with the Commanding Officer and under his sole care and responsibility.

That Officer will be responsible that no copies or extracts are made from it under any circumstances ; and he will be careful, as well, to preserve it in the state in which he shall receive it, and to secure it in such a manner as will prevent all access to it, unless in his presence, or with his immediate permission. ... It will be the duty of each of these Officers, on being relieved, to procure a receipt from his successor, and to transmit it to the Government[6].

[1] CD, to M. 9–2–10 ; *EIMC.* III (329). [2] DDn. 83 (70), 17–7–10. [3] DDn. 127 (227), 29–5–12. [4] Northern, Southern, Central, Mysore, Ceded Districts. [5] Letter of 28–7–14 ; MMC. 26–8–14. [6] MMC. 26–8–14 & 13–12–14.

JAVA

Reference has already been made to the dispute between Gillespie, commanding the forces in Java, and Raffles, Lieutenant-Governor, regarding responsibility for maps and surveys [135–6].

On the departure of the Governor General in November 1811, Mackenzie had been appointed President of a committee "to examine and Register the different Charts, Plans, and public records on the Island". A Dutch officer, Major Cornelis, was placed in charge of local revenue surveyors at Samarang, and prepared maps for the civil commissioners, sending "duplicates of the same, and of all other papers or plans...without delay to Batavia" [135][1].

Early in 1813 Raffles found that various surveys were being carried on by the D.Q.M.G. and his officers without official orders from Government, and ordered that all their work should be submitted to the civil government, and that no future surveys should be started without his orders. To this Gillespie replied ;

> The Department of the Deputy Quarter Master General was constituted under no express limitations ; the duties of it were not particularly defined, and they were accordingly regulated conformably to the usage of the Service. ... Topography is a most important branch of Military Study, on which depends the actual security of our Establishment, and the few records found here were so imperfect and diffused as to be of little use for military purposes. Major Thorn early devoted his attention to the subject, and prepared such Documents as circumstances would admit. ...
>
> A separate Department where these could be preserved and improved is not known here ; a Surveyor General's Office has never existed, and it would follow, if they were deposited amongst other records of Government or sent from the Island, the D.Q.M.G. would be crippled in performance of his duty. ... The Hon. the Lieutenant Governor is already in possession of some important plans ; further information can always be afforded, and future Surveys will only be carried on under the orders of Government[2].

This did not satisfy Raffles, who quoted Bengal regulations in which it was

> clearly and unequivocally defined...that the Topographical Surveys...shall be in charge of a separate Department, ... under the immediate eye of the Government.
>
> It being necessary in the first instance to collect and collate the Surveys and Charts of the former Government, that duty has been executed under the Superintendence of Col. Mackenzie whose abilities and peculiar qualifications...rendered it unnecessary to establish any separate Office of a Surveyor General.
>
> Under the...recommendation of Col. Mackenzie some Topographical Surveys have been completed or undertaken, and an Office has been established...in which several of the Surveyors of the late Government are entertained, and...a review and classification of all the Surveys and Charts in the possession of Government will be framed, and a distribution of them made to the several different Departments. ...
>
> It will then become a matter of consideration what arrangements may be necessary, after Col. Mackenzie's departure, for the due care and preservation of such as are usually under the charge of a Surveyor General ; but it is in the meantime indispensably necessary that all Surveys whatever should be delivered to Government, in order that Col. Mackenzie's report may be as complete and perfect as possible, and that Government may be enabled to judge what further Surveys or Plans it may be...advisable to undertake. ...
>
> The Lieutenant Governor considers the delivery to Government of the Surveys executed by Major Thorn to be absolutely indispensable, as well as every other that is known to exist in any Department of the Service. He has no wish whatever to withhold these documents from the Commander of the Forces, and would on no account retain those Routes and Surveys which appertain to the Q.M.G.'s Department. ...
>
> As it is the intention of Col. Mackenzie to return to India in the course of a week or ten days, the Lieutenant Governor considers it to be of the first importance that no time should be lost in transmitting the Surveys, &c. ... Major Thorn...cannot be permitted to proceed to Europe without having given the assurance, so strictly required, of his not carrying with him Originals or Copies of Documents which are...for the public service alone[3] [287–8].

Thorn protested strongly against the suggestion that he had withheld maps that should rightly have been submitted to Government, or that he had exceeded his duties in taking up these surveys ;

[1] J Cor. 19–11–11. [2] Letter of 14–6–13. [3] Letter of 26–6–13 ; JMC. 26–6–13 (65).

During my absence on service...an order was sent by the Lieutenant Governor to Lieutenant Bayley, who was placed in the D.Q.M.G.'s Department in the interim, to deliver up a Chart of the Island of Java, which I had been at great pains to discover and to obtain from a Dutch Gentleman. ... This Chart, the property of a private Gentleman, thus bargained for and found out by me, was naturally considered as much private property as a Map of England would be, in possession of an English Gentleman.

Lieutenant Bayley...remonstrated...—a peremptory order followed—it was complied with and the Map sent. My claims to it were not even treated with common politeness; I might have been thanked for the trouble of finding it out, as in all likelihood it would never have been forthcoming had it not been for my fortunate discovery.

The want of any correct or authentic Maps of Java made me turn my attention to compile, in the best possible manner, a Chart or Military Sketch which, being founded on the best materials and carefully compared and revised, might prove more satisfactory than any of the old imperfect Charts found here and there. I had the honor of presenting you [Gillespie] with the fruits of my labours...and, in obedience to your desire, one copy was transmitted to H.E. Sir George Nugent[1], and one to the Hon. the Lieutenant Governor[2].

Gillespie submitted Thorn's certificate that he had not retained any geographical papers, but had handed them in to the Commander of the Forces; the map already submitted to the Lieutenant Governor gave the the full results of the survey. Raffles was not satisfied, and replied that

the principal object of this correspondence is not advanced, viz., to place in the possession of Government all the Surveys which have hitherto been retained in the D.Q.M.G.'s Office, and the several Documents connected therewith[3].

As Gillespie stubbornly refused to hand over the original documents, Raffles laid the whole correspondence before the Supreme Government [136], remarking that he had every reason to believe that some Surveys...have been transmitted to England without proceeding through this Government, ... agreeably to the Regulations. It was with a view to avoid this...as well as to complete the general Report on the subject which I expected from Colonel Mackenzie...that I deemed it necessary to adhere to the [Regulations][4].

The Governor General in Council concurred

entirely in the propriety of your having enforced the Regulations of the Hon'ble Court of Directors for the safe Custody of all public charts and Surveys. ...

As we are persuaded that no occurrence of the kind is again to be apprehended[5], we... recommend that the Regulations...be strictly enforced...as far as Circumstances permit; but... it does not appear to us essential that the Specific Office of Surveyor General should be constituted. ... In the absence of the Surveyor General, the Lieutenant Governor in Council will commit the Charts, Surveys, & Papers connected with them, to such public Officers, and form such rules...for the custody of these Documents as he may judge expedient [136][6].

In 1814, in view of probable evacuation of Java by the British, the following army order was issued;

The Commander-in-Chief, in prospect of General Peace[7], and in view of possibility of having to reconquer the occupied possessions oversea, considers it to be a just and necessary precaution that all important Topographical Military Plans, Maps, and Marine Surveys of Java and the other Islands & possessions to the Eastward, which formerly belonged to the Dutch, should be collected and...deposited among the archives of the Supreme Government of India.

The same precautionary measure should...be extended to the Isles of France and Bourbon[8].

"A selection of the most valuable Topographical Surveys in Offices at Java" was sent to Calcutta, and the greater part of Mackenzie's interesting collection of French and Dutch maps of the East Indian islands, some of them copied by his draughtsmen, is still held by the Survey of India[9].

[1] C-in-C. Bengal, 1812–4. [2] Letter of 26–6–13; JMC 29–4–14 (86). [3] Letter of 28–6–13; ib. 3–7–13 (18). [4] ib. 13–7–13 (42–5). [5] Gillespie had now left the Island [136]. [6] Letter of 18–9–13; JMC. 4–11–13. [7] Napoleon had been banished to Elba [8] The meagre military staff at Fort William in 1814 shewed wisdom befitting a Geographical Section, General Staff, of a later age! BSC. 6–7–14 (7). [9] MRIO. Folios 102, 106–9.

CHAPTER XXI

ADMINISTRATION

BENGAL ; Surveyor Generals [I, 260 n.1] — *Marine Surveyor — Assistant Surveyor General, Calcutta — Surveyor General's Office, Calcutta — MADRAS : Surveyor General — Inspector of Revenue Surveys — Quartermaster General — Reorganization, 1810–5 — Surveyor General's Office — Lambton's Survey — BOMBAY ; Surveyor General — SURVEYOR GENERAL OF INDIA.*

COLEBROOKE was the first infantry officer to become Surveyor General. Being himself a keen surveyor and draughtsman, he took every opportunity to extend surveys as far as the Company's influence afforded protection, and did much to raise the standard of work. He held office for over 14 years[1], his long term being closed by his tragic death at Bhāgalpur[2] on the return journey from a survey in the Upper Provinces [33], during which he had taken observations for the height of the Himālayan peaks, and organized the first attempt to reach the source of the Ganges [73, 86–7].

He was succeeded by John Garstin, of the Engineers, who had held charge of the office, and signed for the Surveyor General, during Colebrooke's last year up country. Garstin's only experience as surveyor had been for a short period in Calcutta about 1784, and, though he made an excellent Surveyor General, he was, from 1810, performing the duties of Chief Engineer as well. The Directors did not approve of this ;

> The Office of Surveyor General ought not to be held by the person in charge of the Engineering Department, whose general duties at the head of that Corps must prevent his due performance of those which we expect from the Surveyor General.
>
> This officer ought generally to be engaged in making actual Surveys of such parts of the country as required to be more minutely examined and described, and when not so engaged he should occupy himself in collecting and reducing to uniform scales the Geographical materials collected by himself and others. ...
>
> We therefore desire that you will revise the office and establishment of Surveyor General, ...and that the Officers of the Engineer Corps may be relieved from the duties of Surveyor General[3].

Thereupon,

> The Governor General in Council, considering Lt.Colonel Crawford of the 4th Regt. of Native Infantry to be an officer peculiarly well qualified to fill the office of Surveyor General, ... determined to nominate him to that Situation[4].

Crawford was at this time on the distant survey of Mirzāpur, and it was several months before an officer could be sent to relieve him [47], so he did not take over from Garstin till 9th April 1813[5]. He was an experienced surveyor, being best known for his work in Nepāl during 1802–3, when he took his first observations to the snowy peaks [70–1].

On the abolition of the post of Surveyor General of Bengal, Crawford was ordered "to conduct the duties of it on its present footing until the arrival of Colonel Mackenzie at Fort William" [307][6]. Owing to Mackenzie's long delay in Madras, however, and his own ill health, he was allowed to resign and proceed on furlough, 24th December 1815.

Throughout this period the Surveyor General's department came under the direct orders of the Governor General in Council and, writes Crawford,

[1] only exceeded by Andrew Waugh. [2] 21–9–08. [3] CD to B. 14–2–12 (15–8). [4] BMC. 14–11–12 (157). [5] Garstin still sd. as Surveyor General on 15th April, MRIO. 163 (17). [6] BGO. 1–5–15.

all communications relative to the Department are made to me through the Chief Secretary to Government, or the Military Secretary, with whom alone I correspond. The reports and returns...of the department are sent into the Council alone, and to no other authority or department, as the Surveyor General considers himself immediately under the control and orders of the Governor General[1].

MARINE SURVEYOR

Since the retirement of John Ritchie in 1786 [I, 381–2], a few surveys had been carried out in Bengal waters under the direction of the Surveyor General [I, 66 ; II, 10–2], but in 1808 the Directors appointed John Wales to be Marine Surveyor to the Supreme Government, to be stationed at Fort William, and responsible for all marine surveys in eastern waters ;

Resolved...for the purpose of enlarging and improving the present limited information of the Hydrography of the Indian Ocean, the Office of Marine Surveyor, which formerly for some years existed under the Government of Bengal, be re-established ; and that Captain John Wales of the Bombay Marine Establishment who, from his former employment on Marine Surveys, and in every other respect, appears properly qualified for the Office, be appointed Marine Surveyor in India[2].

Wales had been assistant to Blair on his surveys of Chagos I. in 1786 [I, 123–4], and of the Andaman Islands during 1788–93 [I, 48–9]. He died at Calcutta, 15th January 1810, very shortly after taking over his duties, and was succeeded by Charles Court, who reported his arrival on 13th February 1812[3]. In 1811, Garstin had two rooms built in Fort William "to contain the Records of the Marine Surveyor's Office"[4].

The title Marine Surveyor General was assumed a few years later.

ASSISTANT SURVEYOR GENERAL, CALCUTTA

The first appointment of an assistant to the Surveyor General for office duties, as distinct from duties as field surveyor or draughtsman, was that of Colebrooke, who was appointed to charge of the map depot at Calcutta in 1789 [I, 237]. In 1793, when Kyd was appointed Superintendent in the Andaman Islands, Colebrooke, took charge of the office, and all duties as head of the department, until Kyd resigned in February 1794 [I, 261].

During his many excursions as Surveyor General to carry out surveys in person Colebrooke usually left Blunt in charge of the office [I, 314], but in April 1807 he left Garstin,

with a part of my Establishment of Draftsmen sufficient to furnish copies of any maps that could be wanted, who would deposit them for the time being in his own office in the Fort, without any additional charge to Government [297][5].

For several months correspondence had to be sent up country after him, till Garstin obtained increased powers ;

Although I have really charge of the office...yet, not having been publicly authorized to receive it, I am obliged to send all the Bills, Field Books, etc., directed to the Surveyor General, to the remotest parts of the Company's Territories, which now occasions great delay and when Colonel Colebrooke shall have proceeded beyond the Frontier there will be no means of forwarding them, and the routine of the office will be nearly at a stand unless public authority is given for me to act until his return[6].

In December 1813 Crawford asked for an assistant to help with astronomical observations and their necessary calculations, and after a few months was informed

that Lieutenant John Fleming Hyde, of the 15th Regiment of Native Infantry, and lately employed as surveyor of the suburbs of Calcutta [18], has this day been appointed...Assistant

[1] DDn. 131 (114), 6–1–15. [2] CM. 8–12–08 ; BPC. 10–11–09 (21). [3] BPC. 21–2–12 (11). [4] DDn. 126 (107), 28–9–11. [5] DDn. 81 (61), 12–2–07. [6] DDn. 67 (479), 8–9–07.

to the Surveyor General, with a salary of 250 Sonaut Rs. per mensem, in addition to the pay full Batta, Gratuity, and House Rent of his Regimental Rank[1].

With several spells of leave, Hyde held the post till he took furlough to England in 1821. He was the first assistant to hold office in a permanent capacity.

SURVEYOR GENERAL'S OFFICE, CALCUTTA

Up to 1805 Colebrooke appears to have maintained the office at his private residence in Chowringhee, and in 1804 he pointed out that

the allowances of 90 Sont. Rs. per month...is not adequate for the purpose of hiring a suitable office with glass windows and flues...and, as soon additional accommodation for constructing and copying the maps will be necessary, I most humbly entreat...the same allowance that is granted to all other heads of offices, viz. 250 Sont. Rs[2].

In 1805 he told Government that he was about to move the office, and when he went up country in 1807 he surrendered office rent and pay of a *durwān* in exchange for boat allowance [324]. Garstin suffered accordingly, and complained that

I receive no sort of allowance for my trouble in conducting the business of this office, and taking care of the very valuable and voluminous records thereof. I...have been obliged to find two rooms to contain the presses for plans, etc., large drawing tables, and Instruments, and to find a convenient room for the draftsmen to work in. ... The valuable records, which have cost the public many lacks of Rupees, could not with any propriety have been put into Boats and sent all over the country, at a great risk of being lost or destroyed[3].

Government replied unsympathetically that,

provision having been made...for the plans and records...being deposited under charge of Lt.Colonel Garstin in his own office, ... Government cannot justly be subjected to additional expense on that account. ... Any expense which Lt.Colonel Garstin may have incurred...must be considered entirely a matter of accommodation to Lt.Colonel Colebrooke...to whom he is accordingly referred for his re-imbursment[4].

Two years later, when Garstin was holding the two offices of Surveyor General and Chief Engineer, he obtained sanction for

the construction of an office for the records of the Surveyor General over certain Out-Houses now appropriated to the Royal Gate Quarters in Fort William ; ... it being, however understood that the rooms thus to be constructed will be held applicable to any other public purpose of utility in Garrison, whenever the Office of Surveyor General may be separated from that of Chief Engineer[5].

In 1813 Crawford succeeded in getting a slight increase of rent allowance ;

When the sum for an office was many years back settled at 90 Rs. per mensem, House rent was then infinitely more moderate and reasonable than it now is ; and when it is considered that my office (which consists of a Drawing Office, Tracing room, and Record Office, besides a room to work in myself) ought to be well flued and glazed to render it perfectly dry and free from dust, it must appear evident that no such accommodation can possibly be procured for the money, and, when I add that seven of the Military General Offices are at Rs. 250 per month, I hope I may stand excused in applying for an increase of office rent[6].

The concession recognized that one building should serve as office and residence, and,

Instead of the allowance of Sa. Rs. 120 for House Rent, and St. Rs. 90 for office rent, hitherto drawn monthly by the Surveyor General, His Lordship in Council is pleased to authorize ...a consolidated allowance of Sa. Rs. 300 per mensem[7].

SURVEYOR GENERAL, MADRAS

We have already told of the many refusals of the Directors to appoint a Surveyor General at Fort St. George [I, 263–5], and of Lord William Bentinck putting forward the proposal again in 1804 [124, 290] after the Commander-in-Chief had pointed out that,

[1] BMC. 23–4–14 ; DDn. 141 (6A). [2] DDn. 67 (328), 12–7–04. [3] ib. 81 (10), 28–4–08. [4] ib. 82 (22), 10–5–08. [5] ib. (132), 5–3–10. [6] ib. 143 (17), 7–12–13. [7] ib. 125 (115), 18–12–13.

in Bengal, where the scientific examination of local objects has been uniformly promoted by the liberal encouragement of Government, extensive surveys were instituted at an early period of our power, and an office of Surveyor General has been long established. Excellent maps of the Bengal Provinces have accordingly existed for many years.

At Bombay, where the territories have been so limited, a similar Office has obtained, and the result of Lt.Colonel Reynolds's labours are likely to produce an extensive addition to our Geographical knowledge of the Western and Central parts of India.

A plan was submitted to Government by Major Mackenzie in 1796 for the establishment of a similar Office under this Presidency [I, 264]. That officer justly observed, 'The experience of several years has given me frequent occasion to remark the embarrassments and detriment arising from the want of permanent regular system of carrying on the Surveys on the Coast, and the difficulties that constantly occur in referring to what has been already done for want of an Office where the connexions of the several Surveys with their documents, and the original notes of their construction, could be traced. Hence it arises that some are lost, or being obscure are of little use, while time and expence is lost in going over the same ground' [I, 157 ; II, 303]. ...

The disapprobation of the Court of Directors to establish the Office of Surveyor General, and a consideration of the expences which it would occasion, dissuade the Commander-in-Chief from recommending that measure[1].

General Stuart went on to recommend that all surveys should be placed under the Quartermaster General [300–1] but Bentinck's council preferred

again to request...the appointment of a Surveyor General, and to refer to the facts stated in the foregoing minute of the Commander-in-Chief as additional arguments in support of its expediency. ... It is resolved to take the occasion for the renewal of the former recommendation...in favor of Major Mackenzie, ... whose long and laborious service, and whose distinguished merit in that line of publie duty, combined with his professional talents, render that officer...peculiarly qualified for the Office of Surveyor General[2] [124].

The Directors preferred to put the surveys in the hands of the Quartermaster General, who made elaborate rearrangement of his office [275], and assumed control of all surveys except those under Lambton, Mackenzie, and the Inspector of Revenue Surveys [277]. In 1810, however, General Sir George Hewett, Commander-in-Chief of India, was deputed to Madras[3] to carry out an exhaustive examination of the organization of the army, and remedy the faults brought to light by the mutiny of officers [3, 127, 313–4]. Coming from Bengal, he had no hesitation in recommending the immediate appointment of a Surveyor General ;

Looking...at the variety of surveys now in progress under different establishments, civil and Military, subject to different superintendence and direction, and all pointing to different ends, I conceive that the union of the Survey Departments under the controul and management of some able and scientific officer would produce an unity of system and diminuation of expence greatly to the benefit of the service.

A judicious application of the services of the Civil and Military Surveyors and Draftsmen could not fail to secure the object of the present surveys with more ease, and in less time. ...

What may be required for Military purposes may be found in maps and plans which include a greater extent of information. The prosecution of distinct Military surveys...is therefore a total misapplication of time, talent, labor, and expense. ...

For these reasons the union of the civil and military surveys becomes extremely desirable ; but the conviction that the duties of the Quarter Master General are too extensive to admit of his giving the necessary attention to the information and conduct of a central Depot for the preservation and arrangement of all the Geographical records and materials...has induced me to consider how far some practical plan...might be rendered acceptable to Government. ...

Military surveys are deposited in the office of the Quarter Master General, and Civil and Revenue surveys in that of the Inspector of Revenue Surveys. ... There has been a want of unity and co-operation, ... and a want of permanency in the preservation of the Records. Maps, I understand, have been lost, and the same countries have consequently been repeatedly surveyed. The same countries are also surveyed in the Military and the Revenue Department from a want of a general superintendent authority. ...

I object...strongly to the annexation of this extensive duty to those of the Quarter Master General. The care and management of surveys should belong to a military officer immediately under the Government. ... The arrangement of surveys is a duty which requires the undivided

[1] C-in-C.'s minute 10–8–04. [2] MMC. 14–8–05. [3] Arrived 8–4–10 ; M to CD. 11–4–10 (2).

attention of the officer charged with it, whilst the Quarter Master General's attention is occupied by the camp equipage of the army, the quartering and movement of the Troops, and his duties at the Military Board.

These observations...shew the expediency of establishing an office of Surveyor General for the charge and arrangement of all surveys and Geographical materials; and this measure... may...ultimately occasion a considerable saving of expense, and...afford Government the opportunity of realizing its long desired object of conferring it on that meritorious officer, Major Mackenzie[1].

These recommendations were immediately accepted by Government, and promulgated in a General Order dated 9th October 1810;

With the view of uniting under one superintending authority the whole of the Surveying Department of this Presidency, and of providing more effectually for the preservation and arrangement of the extensive surveys, and other geographical materials at present under the charge...of different officers, whose duties are unconnected with each other; it has been resolved...to appoint an officer of the army to the situation of Surveyor General.

The office of Surveyor General will be placed immediately under the Government, and be subject to the inspection of the Commander-in-Chief. The Surveyor General will be charged with the direction...of all surveys and the establishments connected with their prosecution. ...

The Governor in Council is pleased to appoint Brevet Lieut.Colonel Mackenzie of the Corps of Engineers to be Surveyor General...from the 1st of December next.

The appointment was duly approved by the Directors in a letter dated 3rd September 1813[2].

Mackenzie's own account is as follows;

About the end of 1810, the Madras Government, on a review of the sudden increase of the expense of surveys in the last five years, and of the unconnected, confused, manner in which these works were executed without any fixed general system, found it necessary to create an office of Surveyor General, as already established at the other presidencies; and were pleased to appoint me (without any previous communication with me) to this charge, for reasons that I had in vain attempted to shew the advantage of for 14 years previously[3].

He had only taken over his new office about four months when he was appointed chief engineer to the Java expeditionary force. He sailed from Madras at the end of April 1811, handing over to Morison, who acted as Surveyor General in addition to being Commissary General until Mackenzie rejoined on 30th March 1815. Orders then arrived abolishing the office of Surveyor General of Madras, and appointing Mackenzie Surveyor General of India from 1st May[4].

All Mackenzie's correspondence on survey matters, both before and after being appointed Surveyor General, was carried on with the Public Department.

INSPECTOR OF REVENUE SURVEYS, MADRAS

Early in 1797 Goldingham had been appointed Inspector of Revenue Surveys for the supervision of the assistant revenue surveyors employed on district surveys [I, 145; II, 2, 139], but no regular salary had been fixed for the appointment, and before proceeding on furlough in 1805 he pointed out that,

having been appointed...with a promise of such salary or compensation as the duty might appear to deserve, the Honorable Court of Directors...ordered that an adequate compensation would be granted; accordingly, about May of the year 1800, the sum of 2500 Star Pagodas was presented to me for past services, but as no provision was made for the future, either by annexing a salary to the appointment or otherwise, I have received no compensation whatever from that time to the present, an interval of about four years and an half[5].

He was thereupon granted a second award of 2500 ps., but this time the Directors objected to

so considerable a grant being made without previous reference to us, and before any Reports or Surveys had been submitted to our inspection. We now direct that Mr. Goldingham's

[1] DDn. 84 (9), 27–8–10. [2] M to CD. (Mil), 15–12–10 (12) & 15–3–11 (230) & CD to M. (Mil), 3–9–13 (194). [3] *EIMC.* III (318). [4] MGO. 26–5–15. [5] MPC. 30–11–04.

allowances on account of the Establishment in question do not exceed the sum of 100 Pagodas per month, to commence from the time of its foundation[1].

On Goldingham's departure, in February 1805, his duties were taken over by Warren [195].

In 1807, after a review of expenditure on all Madras establishments, fresh regulations were drafted for the surveying school and the revenue establishment [341–2, 347, 349] ;

The duties of the Inspector of Revenue Surveys not having hitherto been sufficiently defined, they are now determined as follows.

The Inspector is to receive the orders of the Board of Revenue for equipping and dispatching such boys as are to be sent on service. He is to supply...surveying instruments, ... clothes, and other necessary articles. ...

He is to correspond with such of the Collectors as have surveyors under them, and on subjects relating to his department shall be the sole channel of correspondence with the Board of Revenue. On sending from the school such boys as are ordered on service, he is to supply the Collector or Surveyor under whom they are to act with a copy of the...present Regulation.

The Inspector is to receive and transmit the quarterly reports of the Collectors to the Board of Revenue, and to give his opinion on the progress and merits of the different surveys submitted to his inspection. He is to compile and digest these surveys and supply the Board of Revenue with copies of the same.

The Inspector is authorized to correspond officially with those Collectors whose districts are imperfectly known, and to point out to the Board those tracts which...ought to be next surveyed. And, lastly, he is to make himself acquainted with such Civil and Military Surveys as are on foot, with a view to employ and distribute his young surveyors[2].

Later in the year Warren put in a claim for remuneration, supported by a report showing

the number of Boys who have been admitted, and whose education was completed, in the Surveying School since the last remuneration was granted—The number of Assistant Surveyors sent into the Districts, being qualified and expert Surveyors—The number of Surveys and Charts which have been executed in the Department, and...lastly—the degree of Superintendence which these branches of my duty have required[2].

Collectors did not always appreciate Warren's interest, and the Collector of Cocanāda[4] writes ;

I do not feel myself authorized to enter into any communication respecting the District under me without orders through the Board of Revenue, which in the present instance I have not received[5].

The Board of Revenue had then to send out a strong circular calling attention to the regulations above quoted.

The post was abolished on the appointment of the Surveyor General, when Government sanctioned a final instalment of Warren's allowances " in lieu of all charges on account of an establishment or other contingent expenses "[6].

QUARTERMASTER GENERAL, MADRAS

In 1804 the Commander-in-Chief recommended that surveys and maps should be placed under the control of the Quartermaster General [298] ;

A knowledge of the situation of places, of the roads, passes, mountains, forests, and features of the Country ; of the positions proper for the encampments of Armies and Detachments ; ... of the course and description of Rivers and supplies of Water ; of the character, resources, and facilities of Countries, ... is indispensable to the...Quartermaster General.

The duties of that Officer embrace whatever is connected with the movements and positions of Armies, the defence of encampments, and the General arrangement of combined operations as far as these relate to the surface of the Ground. ...

If the charge of Superintending and recording Geographical Surveys shall be entrusted to the Office of Quarter Master General, it will attach to his department those materials which it is the first duty of his situation to study and to know. The measures necessary for their cons-

[1] CD to M. (Rev), 28–8–04 (81–2). [2] DDn. 133 (302–20), 17–1–07. [3] M Rev Bd. 21–12–07.
[4] now in Godāvari Dist. [5] ib. 1–8–06. [6] MRC. 23–11–10.

truction, and their reduction to uniform scales will facilitate his knowledge of their contents, and combine the performance of his own particular duties with the permanent arrangement and preservation of those valuable records. ...

It has been one of the defects of this army that although the knowledge already described is required to be manifested by the Quarter Master General in time of War, no means of acquiring that knowledge have been afforded to him in time of Peace. It is only two years since the Guides have been placed under the Quarter Master General ; and an establishment of draughtsmen, although frequently solicited, has not yet been allowed to that Office.

He recommended

that an establishment of four draftsmen be allowed for the purpose of arranging, copying, and reducing those materials. It will be necessary to grant an allowance of 100 Pagodas a month to the Quarter Master General for the purpose of maintaining that establishment, which will admit of his employing a head draftsman at 40 [and three others at 20] each. It is impracticable to obtain well instructed persons of this description at less salaries.

It will be the duty of that Office to arrange and reduce the surveys, and construct them into General and Provincial maps upon a regular system ; and to supply such copies of them as may be called for. ...

All separate Surveys of a Subordinate and temporary nature should be transmitted direct to the Quarter Master General, and the persons conducing them should receive instructions from that Officer[1].

These proposals were duly approved by the Directors, who noted that " the additional establishment of Draftsmen required...will be defrayed from the Reduction effected in the Command of the Corps of Guides [313]", and the changes came into force from November 1806 [290][2].

The surveys that were carried on under the direct control of the Quartermaster General were those of the Military Institution, the Travancore and Hyderābād surveys, and a few others, nearly all the surveyors being officers from the Military Institution. Instead of the four draughtsmen suggested, two officers, Kinsey and Low, were employed on the examination and arrangement of the records, and a certain amount of map-drawing[3].

On the appointment of a Surveyor General under General Hewett's scheme of 1810 [298–9] these two posts were abolished, but the Quartermaster General was allowed a number of officers to be employed on surveys of an urgent military nature, provided that no officer should be so employed until he had completed two years with his military unit. These officers were to submit their surveys to the Quartermaster General, who should make copies for his own office and then pass the originals to the Surveyor General. The Quartermaster General was also given the right to call for such maps and documents as he might require from the Surveyor General's office, to returning them " at the earliest practicable time"[4].

The distribution of maps between these two offices gave rise to considerable friction, but Government insisted that full responsibility for geographical maps must rest with the Surveyor General [291].

It was later directed that the Quartermaster General was

to make Quarterly Returns to the Office of the Surveyor General of the expences incurred on account of the Officers, Draftsmen, and Writers, employed under his direction in surveying or exploring, ... and of instruments in use in his Department[5].

The Military Institution remained under the Quartermaster General until its disbandment, though the annual programme of survey was settled in consultation with the Surveyor General.

Reference has been made to the dispute between the civil and military authorities at Java regarding the control of surveys [135–6, 293–4]. The Lieutenant-Governor, Raffles, saw no reason why Bayley, an officer of the Q.M.G.'s department, should postpone his departure from the island in order to complete surveys which had not received formal approval. He writes to the Military Secretary ;

It is well known that [in] all the presidencies of India the Surveyors' Department is exclusively confined to one Establishment of Officers, who are specifically appointed by the

[1] C-in-C.'s minute, 10–8–04 [123–5]; MMC. 14–8–04. [2] MGO. 20–12–06 ; CD to M. 9–8–09.
[3] President's minute, 31–12–10 ; MMC. 29–1–11. [4] MGO. 9–10–10 (4, 5). [5] MPC. 19–5–12.

Government for the execution of such surveys as appear to the Government to be necessary and proper ; that the Surveyors' Department in Bengal is perfectly distinct from the Quartermaster General's and, by a recent order of the Hon'ble Court of Directors, is separated from the Engineer's Department so decidedly that the Chief Engineer is declared incapable of being at the same time Chief Surveyor at that Presidency [295].

In the Presidency of Madras in like manner the Surveyor's Department has been made distinct and separate. ...

As this Government is a direct dependancy of Bengal, and is immediately bound to conform to the Regulations of that Service, it follows...that the officers of the Quartermaster General's Department are not...to employ themselves in executing surveys, and that no Surveys ought to be made without the special authority or orders of Government[1].

The civil government carried the day, but before sailing Bayley informed the Lieutenant Governor, as a parting shot, that,

at Madras (where I was engaged for near seven years, either in the study or practice of the different branches of Survey, &c.) ever since the appointment of a Surveyor General, all Surveys, Routes, &c., of a purely Military nature are still carried on in the Quarter Master General's Department, and no less than twenty Officers (educated in the Military Institution for the express purpose) appointed under him for the conduct of the Survey Branch under his orders [322–3][2].

REORGANIZATION, MADRAS, 1810–5

The regulations of the 9th October 1810 [299][3] threw full responsibility for all surveys on the Surveyor General, and Mackenzie at once started to work out a "Plan of arranging the Surveyor General's Department & generally all Surveys under the Presidency of Fort St. George "[4]. This entailed an exhaustive examination of surveys already completed, or still in progress, and a consideration as to how the various surveyors should now be employed, and what should be done with those who could not be fitted into the new organization. Mackenzie claimed that by his plan

the saving of about one third of the present expenditure...is obtained, without infringing on any of the ancient establishments of the Government, Military or Civil, without touching the Military Institution, & with the incalculable advantage of planing the great object of Surveys under one inspection & direction.

He had also to prepare detailed regulations to provide

that every officer or other person employed in it, whether in the department of the Surveyor General or Quarter Master General, shall report...the manner in which they may be employed, in order that a General Quarterly report may be prepared[5].

Mackenzie was still working on these reports when he had to leave for Java [135], and it was four years before he returned to Madras. Towards the end of 1814, while he was in Bengal writing up his Java reports, he discussed with Crawford the organization of surveys in Bengal, first asking formal permission to do so ;

It appearing to me extremely desirable that I should avail myself of the present occasion ...to obtain such knowledge of the Office of Surveyor General under this presidency as may assist an uniform system of the like duties at Fort St. George, ... I request that you will be pleased to submit to the Honourable the Vice President in Council the propriety of sanctioning such communication with the Surveyor General here. ...

Having in the course of a late journey thro' the Upper Provinces paid all possible attention to the face and features of the Country, and the mode of conducting the surveys [83, 88], with a view to the improvement of this branch of the service under...Fort St. George, ... I am... encouraged to hope...it may aid the establishment of a simplified system, and...uniformity, ... and...facilitate the progressive improvement of the Geography of our Indian possessions in General[6].

He sent a copy of the Bengal regulations to Morison ;

You will recollect this was an object of considerable solicitude with me immediately previous to my being ordered for the Expedition to Java, ... to obtain the information from the different Presidencies. ...

[1] JMC. 18–5–13 (150). [2] ib. 7–6–13 (580). [3] DDn. 192 (247–50). [4] DDn. 86. [5] MMC. 29–1–11.
[6] Letter to Supreme Govt., 12–10–14 ; MPC. 12–1–16.

In my pursuits in the course of investigation of the Geography of the Deccan so early as 1797–8, I had then seen...the utility of a communication with the Surveyors General at the Presidencies of Bengal and Bombay, with a view of accelerating the improvement of Geography, and preventing unnecessary trouble and expense of resurveying the same ground [298]. ... In consequence of which mutual communications took place [I, 255]. ...

The motives appearing still more forcible now, ... I conceive the...opportunity while I am here, of obtaining such information...for conducting the surveys on one fixed system best adapted to...obtaining a more complete knowledge of the country in an uniform method, attended with the least expense[1].

There is no doubt that the experience of other systems which he gained during his four years absence gave Mackenzie a much wider outlook on affairs in general, and helped him on his return to Fort St. George in 1815. A few months after his return he submitted

a comparative view of the surveys executed for several years past. I consider this method of employing parties of Native[2] Assistant Surveyors under the immediate controul and direction of an experienced European surveyor, as the most effective for completing the General survey of the Company's possessions, and that allowances superior to the present salary of 60 Pagodas per month on such a duty is consistent with every principle of public economy and diminuation of unnecessary expense, by completing them rapidly and effectually on the same plan as been adopted in Mysore, in the Ceded Districts, and lately in Soonda[3].

An account of the survey parties he proceeded to raise must be left to another volume.

SURVEYOR GENERAL'S OFFICE, MADRAS

On appointment to charge of the Mysore Survey, Mackenzie's first thought had been for a clerk, or writer, whom he obtained from the male asylum in the person of Lucius Rawdon Burke[4]. Burke remained his personal and confidential clerk for the next twenty years, and in 1817 became the first Registrar to the Surveyor General of India[5].

On his appointment as Surveyor General from 1st December 1810, office establishment was fixed at "3 Draftsmen ; 3 Writers ; 1 Assistant Surveyor ; Total 7, besides Native Writers in Office"[6], whilst office rent was fixed at 50 ps. a month. He took with him to Java his head writer, Burke, his private apprentices, Lantwar and Newman, and two sub-assistants [164].

Ward was brought in to take charge of the office under Morison [163, 277, 314] and the establishment comprised ;

Cavelly Venkata Lechmiah	Head Interpreter & Translator in Tellinga & Sanscrit.
Anthony Rodrigues	English Writer.
Domingo Ferrier	,, ,,
Christian Andreas Ignatio	Draughtsman.

besides eight assistant surveyors and apprentices who were employed in the drawing office pending the start of fresh field surveys[7] [278].

In December 1811, on Warren's resignation and Ward's temporary appointment to charge of the Observatory [196], the office was moved to the observatory buildings, and Mackenzie records that,

upon my return (in 1815), I found the office and Depot had been repeatedly moved and changed. On December 22nd 1811 it was directed...to be removed to the...Observatory Buildings, whereby...for some months...the Office rent ceased to be drawn, but on the return of the Astronomer from Europe...it was again removed...so suddenly on the 1st April 1812 that the Acting Surveyor General was under the necessity of hiring the only house procurable ...for 80 Pagodas per month. ... But this house being found ill adapted, ... another house was taken at 100 Pagodas per month, and the difference...was meantime defrayed from my private funds during my absence.

Additional to...that house, temporary accommodation was arranged in the out-offices and by tents for the increased number of assistant surveyors at work. In this state I

[1] Letter of 20–11–14. [2] country-born [I, 283 n.8]. [3] MPC. 20–11–15. [4] appd. March 1800. [5] SGO. Est. List, DDn. 198 (88), 15–6–22. [6] MPC. 28–9–16 ; para 47 n. (*a*). [7] ib. 17–3–12.

found the Office and Depot embarrassed, and in June 1815...the whole was again removed to the House occupied at present, which I was under the necessity of purchasing, in order to obviate further inconvenience. ...

In allowing an House rent of 50 Pagodas per month, the intention was to provide an Office for the Surveyor General and for a moderate establishment, ... with suitable Rooms for Drawing and Writing. It was not foreseen at the time that additional accommodation would be requisite for the bulky almiras and Bureaus containing the Depot of Charts, Records, and Instruments. ...

At this moment the Depot of Charts alone, consisting of upwards of 2,000 Charts, occupy 8 large almiras, and require of themselves several spacious apartments, besides the Drawing rooms for the Draftsmen and Writers originally estimated.

The Surveying Instruments require a commodious dry appartment, and it was only by alterations at a certain expense that the Out Offices have been fitted up as Drawing Rooms for the Assistant Surveyors and Draftsmen, and for the late Assistant, Lieutenant Ward, exclusive of the principal house, wherein the Depot and Rooms allotted for the Surveyor General's Office occupy the whole of the first, and part of the second, floor. ... It was sometimes necessary to pitch tents. ...

Actually employed at times in the Drawing Room, particularly from June to December 1815 ; 4 Writers ; 4 Draftsmen ; 12 Assistant Surveyors ; 1 Javanese Writer. Total 21, besides 1 Assistant in the Office Depot, and 18 Native Writers, Interpreters, &c[1].

The "native writers" were largely employed on Mackenzie's archæological and historical work [355–7].

It was not until June 1817 that Government decided the weighty matter of rent;

The Office rent...will be fixed at eighty five pagodas per mensem from the 1st of April 1812, ... and an additional allowance of twenty pagodas per mensem will be granted from the 1st of December 1810 to the 21st of December 1811, besides the allowance of fifty pagodas per mensem already drawn[2] [278].

LAMBTON'S SURVEY

From the time that Lambton was appointed to his General, or Trigonometrical, Survey, he took orders direct from Government, corresponding through the Public Department. As early as 1807 he asked that he might be transferred to the control of the Supreme Government, a step that was recommended by Petrie, then acting as Governor ;

The suggestion...is perfectly consonant to the opinion I have long entertained, and submitted in an early part of Lord Clive's Government, that, from the nature, object, and comprehensive view of this survey, it should not be exclusively placed under the directions of a subordinate Presidency, but transferred to the more immediate superintendence and authority of the General Government of India[3].

The transfer, though greatly desired by Lambton, was not effected till 1818.

In June 1810, as a result of orders from the Directors, the Quartermaster General became responsible for the custody of Lambton's records, being satisfied with a list of trigonometrical data[4] [291], and, on the appointment of the Surveyor General a few months later, it was provided that,

The object of the survey under the direction of Major Lambton being of a different nature from that of any others above alluded to, that officer will be authorized to report as usual direct to Government, but he will communicate copies of his reports and plans for the information of the Surveyor General[5].

In 1811, when the time came for extending his survey northwards into the Ceded Districts, Lambton had no hesitation in offering to devote himself entirely to the survey and break from his regiment which was then leaving India. His offer was accepted with compensation in the way of rank and salary [333]. He was told that

the Governor in Council, being of opinion that the Trigonometrical survey, which has been carried on under this Government for a period of nearly eleven years, should be extended into the Ceded Districts, the Dekan, and the Northern Sirkars, ... was pleased to direct that the

[1] MPC. 28–9–16 (45–8). [2] To Civil Auditor, 24–6–17 ; DDn. 142 (114). [3] MPC. 10–11–07. [4] DDn. 91 (88), 6–6–10 & (93), 27–1–10. [5] MGO. 9–10–10 (16).

question should be submitted to the Right Honorable the Governor General in Council, and that...after the departure of your Regiment to Europe you should be detained until such time as His Majesty's pleasure should be known and, in consideration of the...time which you have devoted to the work...which...has now become of some 'national importance', ... you should be indemnified, as well as rewarded, for your trouble and services. ...

His Excellency...has acquiesced, ... and...the Commander-in-Chief in India will be happy to grant you leave to remain in India after the departure of H.M.'s 33rd Regiment until His Majesty's pleasure shall be known, for the purpose of enabling you to prosecute the important surveys on which you are at present engaged[1].

BOMBAY

By 1803, Reynolds, who had been Surveyor General of Bombay since 1796 [I, 265], had three assistants [323], of whom Drummond was senior by appointment, though Williams, the last joined, was not only senior by military rank but also far the most capable. This led Reynolds to ask that Williams might be officially appointed as his deputy ;

It is probable that as the season advances I shall be under the necessity of having a change of air, either by going to Surat, or proceeding to the Presidency for a short time. ... I shall feel great distress at leaving my business under Mr. Drummond who, altho' a very industrious and good young man, is not equal to so great a charge. Mr. Williams is a very steady man, and possesses abilities fully equal to the purpose but, from his being appointed an assistant only, he must of course be under Mr. Drummond who stands as my first Assistant by his appointment.

It is essentially necessary that there should be a Head to conduct the business should my absence from hence become indispensable. ... I hope you will...favor me with an order for him to act from the day of his appointment as my Deputy till further orders[2].

He repeated this request even more urgently six weeks later ;

It will be a very distressing circumstance for me to leave my business just now, even for a short time, but I fear I have no alternative. ... It appears singularly hard on me that Mr. Drummond's feelings should be more attended to than me...and that, with a heavy load of responsibility, I should not be allowed to take the utmost advantage of the abilities of the Gentlemen placed under me. God knows, I am as unwilling as any person can be to injure the feelings of Mr. Drummond, yet I cannot help soliciting you again...for Mr. Williams to act as my deputy. ...

Mr. Williams is ignorant of the applications I have lately made on this subject, but I took an opportunity the day before yesterday of mentioning to him...the probability of my leaving Cambay for a short time ; when he immediately asked me what was to be his situation during my absence, observing...that he would not receive orders from Mr. Drummond, for no consideration would ever induce him to receive orders from a junior officer.

An order was accordingly issued

that Lieutenant Williams stand appointed to the office of Deputy to the Surveyor General, with retrospect to the period of his nomination to proceed to assist Lieutenant Colonel Reynolds in his present Geographical work[3].

Shortly before he left India, Reynolds asked that Williams might be nominated to succeed him, pointing out

the necessity of the person appointed to succeed me being one who possesses fully my confidence. ... I therefore recommend that Captain Williams should be my successor, and be immediately...put in orders to take charge of my papers from me, and that Lieutenant Sutherland should be nominated to the situation lately vacated by the resignation of Lieut. Drummond. ... For both Captain Williams and Lieut. Sutherland have as yet had nothing but the consolation of their own minds for the arduous attention which they have paid to the discharge of their duty, which can be never surpassed, and...is seldom equalled.

In pointing out Captain Williams to be my successor, I do but simple justice, for who can have an equal claim ? And I propose it from a thorough knowledge of his character, which fits him in...a pre-eminent degree for it. ... I feel it but justice to declare that, without the

[1] DDn. 62 (112), 21–5–11. [2] from Cambay, where the office appears to have been moved temporarily; [3] BoMC. 25–10–03.

unremitted and united exertions of these two Gentlemen, my work would not have been in the state of preparation it is now[1].

Williams was duly appointed to succeed as Surveyor General, and took over on 2nd March 1807 [I, 380; II, 323].

The post of Surveyor General at Bombay was abolished under the same order that created one Surveyor General for the whole of India [*inf*], and was notified in a General Order issued from Bombay Castle on 1st February 1815;

In pursuance of orders received...from the Hon'ble the Court of Directors, as contained in a letter to the Supreme Government of the third of June 1814, the Right Hon'ble the Governor in Council is pleased to abolish the office of Surveyor General at this Presidency, and its establishment, from the 28th of the present month of February, and to direct that all Charts, Maps, and other official documents, now under the charge of the Surveyor General be delivered over to the Chief Engineer[2].

Though the abolition of his post was a serious disappointment to Williams, it had little practical effect at the time. For many years the Surveyor General of India shewed little interest in the surveys that continued to be carried on under the Bombay Government, most of them under the control of Williams, who signed himself "late Surveyor General". He retained custody of all geographical material, and kept up a drawing office from which he supplied his Government with all the maps they called for.

The revenue survey of Bombay and Salsette Islands under Dickinson had at no time been under his control. Dickinson received his orders direct from the Bombay Government.

SURVEYOR GENERAL OF INDIA

On 3rd June 1814 the Directors issued a dispatch which revolutionized the administration of the surveys of India;

1. Having taken into our consideration the state of the Department of Survey in India we are particularly struck with the magnitude of the sums which have been expended on it. ...

15. We have nothing to object to [in] the conduct of the officers appointed Surveyor General; on the contrary, we are of opinion that great zeal and assiduity have occasionally been manifested. ...

16. At present we cannot but deem a portion of this expense misapplied, because it is bestowed in maintaining three distinct establishments of Surveyor General, not only where one would suffice for every useful purpose, but where the three are liable, by pursuing separated objects, to prevent any one from concentrating the information procured at the three Presidencies into one uniform geographical performance [286–7]. ...

17. ... We deem this a proper time for *reforming and regulating the department of Survey.* We have accordingly come to the following resolutions. ...

18. The present offices of Surveyor General at each of the three Presidencies to be abolished.

19. A Surveyor General of India, open to selection from the three Presidencies, to be appointed and stationed at the Presidency of Fort William [9, 325][3].

This order reached Calcutta in November, and copies were sent out to Madras and Bombay on the 25th of that month. Nomination for the new post was referred to the Governor General, Lord Moira, who, in his secondary capacity as Commander-in-Chief, was on a grand tour up country directing the start of the Nepāl War[4]. It was not until 17th April 1815 that he communicated his orders;

His Lordship has turned his attention to the selection of a fit officer for the Situation of Surveyor General of India from the officers of all the Presidencies, and conceives that the claims of Colonel Mackenzie, of the Madras Engineers, are the most imperious, as well on the ground of length of service and seniority in the Survey Department, as from the satisfaction Government has uniformly expressed at the many services in this line of his profession. ...

His Lordship has accordingly nominated Lt.Colonel Mackenzie...to the situation of Surveyor General of India[5].

[1] BoMC. 13–1–07. [2] Tho' Bombay Govt. issued eulogy of Reynolds' services under Bo GO. 10–2–07 and Bo to CD. 25–2–07 (16), date of departure is given as 2nd March under CD to Bo, 7–9–08 (10). [3] CD to B. 3–6–14; DDn. 142 (4). [4] Hastings' *Journal*. [5] BMC. 5–5–15 (8).

The decision was promulgated by a General Order issued at Fort William on May 1st, which stated that the appointment carried

the monthly salary and establishment as at present drawn by the Surveyor General of Bengal. The date from which Colonel Mackenzie's appointment is to have effect will be notified hereafter[1].

Further reference had to be made to the Governor General as to the date from which Mackenzie should draw the allowances, the Military Department recommending that this should be the date of his arrival at Fort William. Lord Moira did not agree ;

His Lordship is of opinion that Colonel Mackenzie cannot in justice be refused the allowances of his situation from the moment of his appointment by the Supreme Government [May 1st], more especially as the office is General to all India, and has no particular reference to this Presidency. ...

Colonel Crawford will possess a prior claim to the allowances now enjoyed by him whilst he continues to perform the duties of his office, which he will of course do until he may make over charge of it to Colonel Mackenzie [295][2].

The Directors had, in the meantime, come to the same conclusion as the Governor General, and in a " separate letter " dated 10th March, 1815, sent out orders for the appointment of Mackenzie, to which Bengal replied by communicating their own order, adding that they were " extremely happy to find that by this appointment the wishes of your Hon'ble Court have been anticipated "[3].

Mackenzie had reached Madras on March 30th, after an absence of nearly four years, and the announcement of his appointment was communicated to him by a letter from the Madras Government dated May 13th. For the next two years he found so much work to do at Madras that he did not move to Calcutta until July 1817 [302–3].

[1] BGO. 1–5–15 ; DDn. 142 (29). [2] BMC. 9–6–15 (2). [3] B to CD. 12–9–15 (49).

CHAPTER XXII

SURVEYORS

Education — Bengal — Madras; — Military Institution — Quartermaster General's Department — Lambton's Survey.— Java — Bombay.

THOUGH the conditions of service for the Company's military officers had been vastly improved by the regulations of 1796, it was some years before satisfactory arrangements were made for their education and training.

From 1798 to 1808 about half of the cadets for the Company's artillery and engineers were educated at the Royal Military Academy, Woolwich [I, 156 n.1, 316], whilst a smaller number were educated at the Military College at Marlow that was moved to Sandhurst in 1812. For some years candidates for the engineer corps came out in the artillery, and were transferred to engineers as they passed a test, and vacancies occurred.

To meet the expansion of the scientific services necessitated by the vast extensions of British territory after the Mysore and Marātha wars, the Company opened its own college at Addiscombe in 1809[1]. This was at first confined to artillery and engineer cadets, but was thrown open to other arms from 1816, up till which time there had been no arrangements for the special education of the Company's cavalry or infantry cadets in England.

Under the administration of Marquess Wellesley a college for infantry cadets was opened at Bārāsat, 16 miles north of Calcutta, which lasted from 1802 to 1811. The college for young civil servants at Fort William, at which selected military officers were allowed to study Hindustani, lasted from 1800 till 1854. The Madras Government followed suit with a training school for infantry and cavalry cadets at Tripasur[2], from which pupils were selected for training in mathematics and survey at the Military Institution [2, 125, 314–21].

From 1812 the practice was started of keeping a number of engineer cadets in England for an extra year after passing out of Addiscombe, in order to attend a special course with the trigonometrical branch of the Ordnance Survey.

The course may be considered as consisting of two Branches ; the first instrumental surveying, and the second sketching and drawing ground.

The first Branch was begun by lessons and essays in surveying with the Chain alone, after which the use of optical instruments for taking angles was introduced, and the practice pursued... till the pupils were capable of taking instrumental surveys of Fields, Roads, etc. ...

Essays in levelling were given, and from these the profiles of the ground...were formed.

The nature of a trigonometrical survey, and its application to regulate and correct other operations, was shewn and practically illustrated by taking the small series of triangles near Worcester. ...

The mathematical and mechanical art of Land Surveying being thus communicated, its application to Military and general purposes was explained, and the second branch of instruction...was to communicate a method and art of observing and describing ground...with relation to Military and general objects[3].

The Directors were anxious that these courses should continue ;

From the evident success which has attended the plan of sending (for a few months) our Engineer Cadets on the Trigonometrical Survey...after they have passed their public examination at our Military Institution, we now...adopt this measure for all those Cadets who

[1] Sandes, II (348); Hodson, I (xxiv). [2] Tiruppachchur, 57 O/16, 30 m. E. of Madras. [3] Note 24–10–12 by Robert Dawson, (1776–1860); Dmn. & Survr., OS.; *DNB.* DDn. 129 (41–7).

may hereafter be selected for the Corps of Engineers, from a conviction that they will acquire much practical experience in every branch of surveying, whether Military or Civil[1].

In the event of new surveys being required in Bengal, or at the subordinate Presidencies, it is presumable that officers perfectly qualified for such undertakings will be found among those who have finished their education at our military seminary[2].

As it happened, however, it was found both in Bengal and Madras that engineer officers could seldom be spared from other professional duties, and surveyors had to be found from cavalry or infantry. In Bombay alone was any large number of engineer officers employed on survey. As early as 1801 Mackenzie declared himself definitely

averse to have any more of the Corps of Engineers on this service, being so liable to be called off occasionally, whence the service materially suffers by removal before the tract in hand is closed, and a very great loss of time and embarrassment is occasioned. ... Even the partial removal occasioned by sickness is very detrimental. I have been also unwilling to apply for any more of the Corps of Engineers, as a partiality for one's own Corps is sometimes suspected. Tho' I was sensible of the detriment to the survey from not having the number I originally proposed employed, I have hitherto been silent, waiting to see if any offered for this service not subject to this inconvenience[3].

Whilst training in survey was specially provided at the Madras Military Institution, the only training that Bengal officers received was through the occasional attachment of young assistants to the more experienced surveyors [24–5, 311 n.2]. Spasmodic efforts were made to hold special classes at Calcutta, and Colebrooke suggested that

a Mathematical Teacher to instruct the gentlemen of the Army, or others, in surveying and practical Astronomy would be very desirable, no one having yet been sent out to supply the place of the late Mr. Reuben Burrow [I, 271, 318][4].

Garstin comments in 1812 on

the great care taken with the education of all the young officers of Engineers lately sent out. ... They are well qualified to be employed, first as assistants, and after in any way their services may be required[5].

Crawford spent two hours a day giving lessons in astronomy [193].

In 1810 orders were sent out from home directing that

hereafter no officer may be permitted to hold any staff or official situation whatever, except the Regimental one of Adjutant, until he shall have served five years with the Corps to which he belongs [318]. ... No officers in our service should be appointed to staff situations, unless they have previously acquired a competent knowledge of the Hindoostany language, which is the vernacular language of Hindoostan, and more or less understood throughout the Deccan[6].

BENGAL

The Surveyor General's four assistants, whose posts were abolished in 1801, had been appointed several years earlier for particular duties, but as there had been no call for some time for their services as surveyors they had drifted to other duties, still retaining their allowances, until some unsympathetic officer pointed out the waste of public money [I, 271; II, 4].

New responsibilities in Oudh, however, and the acquisition of territory from the Marāthas, soon created a demand for skilled surveyors that steadily increased. To start with, the engineer corps was the obvious source of supply; Wood, Robertson, Fleming, Smyth, and others, but during the Marātha war a number of regimental officers were employed on route surveys, and of these Sackville, Webb, and White, in particular, became most valuable surveyors. All fieldbooks were sent in for the Surveyor General's inspection, and any special talent was thus brought to his notice. He writes to Sackville;

Only a week ago I recommended that surveyors employed with detachments should be detached by their respective Commanding Officers, on every opportunity that might offer, to

[1] CD to Bo. 18–12–12. [2] CD to B. 3–6–14 (22). [3] DDn. 41, 14–10–01. [4] DDn. 67 (114), 31–7–02. [5] DDn. 126 (133), 9–4–12. [6] BGO. (VP), 20–8–11.

survey and reconnoitre the country, but the news of Lord Cornwallis's illness [31 n.1], and of Sir George Barlow's[1] departure to Benares, has prevented for the present my sending it in. Some regulation of this sort is much wanted, as the Surveyor General is not authorized to send orders or Instructions (more than general Instructions as to what is most desirable for Geography) to any officer serving with an Army or Detachment[2].

He did not at this time have the right to nominate surveyors for particular tasks, and there was apt to be jealousy. He complains to the Quartermaster General of not having been officially informed of White's appointment [59], " as well as of his being in want of instruments ". White, later, was very disgusted at not being sent with Elphinstone's mission, and about delay in passing his allowances, and Garstin was

concerned...to observe...a spirit of dissatisfaction by no means warranted. ... When I pointed out to you what I considered as wrong, as it was my duty to do, I certainly made use of no improper language, ... whilst I was using my utmost endeavours to get your bills passed. ...

You take offence at my not meeting your wishes, and recommending you in preference to others for a new appointment, and...seem to consider your services as far more meritorious than those of other officers. ... Surely Lieutenant Sackville, while surveying Bundlecund, surrounded by men openly at war with our Government—and Lieutenant Webb, on his survey to explore the sources of the Ganges—were exposed to as much danger from the natives, and both to more from the unhealthiness of the climate, than you have been. Your merits have neither been denied or concealed, but men are not competent judges in their own cases. ...

When you solicited employment as a surveyor, it is probable you were acquainted with the regulations respecting allowances. ... To expect one Rupee more beyond what the public orders assign was to indulge hopes that could only lead to disappointment. Except when actually employed in the Field during the rains, no increased allowances can be granted. ...

Why suppose Government could act unjustly towards you ? ... You make the evil you complain of. As Surveyor General I am desirous of assisting every officer...whose conduct deserves encouragement ; but, as an individual, I know of no reason why I should unjustly prefer your interest to that of others ; and you must allow me to say that the style of correspondence that has passed between us has not been calculated to encourage my desire to serve you. ...

I shall take no steps to get you recalled but, if you think proper to resign the situation of surveyor, there are many able officers who will be glad to obtain it[3].

Garstin was very angry with Tickell for his delay in submitting fieldbooks and maps, which he contrasted with Macartney's promptness [218–9] ;

Every officer in the Engineer corps may rely upon it, as may all who may be employed under me as Surveyor General, that only those who are attentive to their duty will meet with any encouragement. The Esprit de Corps will induce me to give a preference to Engineer officers as surveyors, because I consider the practice of this branch of science to be greatly useful to them, and beneficial to the service, but no motive will make me recommend those who are idle or neglectful[4].

It became more and more difficult to spare engineer officers for survey, though when a successor was required to relieve Crawford in Mirzāpur, Robert Smith got the nomination by virtue of being on the Commander-in-Chief's staff. When a surveyor was required for the Calcutta suburbs, Garstin had to report that

there is not an Engineer officer in Fort William to do...even the common subaltern duties which, for several months past, have been done by me as well as I have been able, or they must have been totally neglected. It will therefore be evident that no Engineer can be spared for the survey required[5].

Smyth had to be called off his survey of the southern frontiers to act as engineer with a military column [46], and William Morrieson was in like manner called from the Sundarbans to become engineer at Chunār [17]. It was gradually realized that infantry officers made equally welcome assistants. Fleming was struggling alone with his large-scale survey of Murshidābād in addition to being garrison engineer, when he wrote to the Surveyor General for assistance ;

I cannot help thinking it rather hard that I, an old officer of rank, and 2nd in the corps, should...be kept without an assistant though doubly employed, ... although junior officers,

[1] Vice-President of Council ; GG. 1805–7 ; Govr. Madras, 1807–12. [2] DDn. 79 (B), 10–10–05. [3] DDn. 81 (112), 5–6–09. [4] ib. (184), 28–12–09. [5] DDn. 128 (133), 4–3–13.

Captain Smyth and Lieut. Morrieson, have had assistants appointed to them, and one of them an Engineer officer, in the very teeth of what Garstin wrote to me, that there was not an officer unemployed, or that could be given me ! ! ! ... *But this between ourselves*[1].

Crawford replied;

Tomorrow morning I shall make a point of forwarding your letter; ... and...shall aid your request for an assistant; but if you get one, it must be from the Infantry, as there is not a soul to spare from your corps [20, 61, 310]. It is true that Captain and Lieut. Smith (both of your corps) have each an assistant from the Engineers, but Lieutenants Morrieson and White have each one from the Infantry[2].

In applying for an assistant, ... selection must not be made by the person applying, as Government, of course, reserve to themselves the patronage of the appointment[3].

John Schalch, an infantry officer, was appointed, and Crawford points out that, in drawing *assistants* from the Native Corps, it is not only to aid in expediting the Work, but it is also that they may be *taught* their duty, for they must all have a beginning, and if young Schalch, or as it is pronounced *Shock*, was to be exchanged, the other one you might get would be in exactly the same predicament. He is extremely goodnatured, and is a very fine lad and, what is better, is extremely anxious to get on in this line, and I am convinced will exert himself to the utmost to meet your wishes. He has Surveyed and laid down the Cantonments of Etawah[4].

Fleming was delighted with Schalch, who eventually became a most valuable surveyor.

In 1813 it was ordered at Garstin's suggestion that,

as a general Rule, ... one or more Assistants shall be attached to Officers employed on Extensive and laborious surveys, with a view, not only of saving time and money, but of forming Surveyors at no great expence, and of having at command a certain number of Officers possessing that accurate local knowledge, the application of which is so frequently required in the course of the Public Service[5].

At the suggestion of the Commander-in-Chief, the proviso was added that not more than one or two were to be drawn from one corps, and in 1815 the general terms of employment were that

there is no separate body of Surveyors; the officers employed in that line are chosen by the Governor General from the Native Regiments of the line, the corps of Engineers and Artillery, or the Corps of Cavalry. No officer whatever is employed in this branch under the Quarter Master General; when a survey is ordered, the Surveyor General is requested to furnish Instruction to the Officer proceeding on the duty.

There is no permanent establishment of surveyors; officers are employed as surveys are wanted, and when the Survey is finished they return to their Corps. Assistant Surveyors are to be selected from the Regiments of the line, as far as two subalterns per Corps[6].

Regarding their instructions for the appointment of a Surveyor General of India the Directors pointed out that

the Ruling principle of those orders (Letter of June 3rd 1814) was the establishment of one responsible Officer for the management and controul of all the Surveys of India and, in conformity to this principle, we direct that no appointment be made in that Department except on the application and consequent responsibility of the Surveyor General[7].

The following is a list of surveyors and assistants employed under the Bengal Government between 1811 and 1815[8].

Name	Corps		Number of Months employed 1811	1812	1813	1814	1815	Survey
Barton	Inf.	[41–2]	..	..	..	2	4	Nepāl War.
Blake	Inf.	[34–6]	..	4	8	8	..	Gorakhpur.
Blane	Engrs.	[5–6, 19]	..	1½	1½	6	6	Diamond Harbour Rd. Sāgar I.; Nepāl War.
Cheape	Engrs.	[19, 178]	..	..	..	..	8½	Chittagong.
Colvin	Engrs.	[16]	..	2	..	..	..	Cooly Bāzār, Calcutta.
Crawford	Inf.	[45, 47]	..	4	2½	Surveyor General		Mirzāpur.
Davidson	Engrs.	[18]	..	..	..	..	1	Dum Dum.
Ferguson	Inf.	[47]	..	..	1	2	½	Routes, Chota Nāgpur.

[1] DDn. 130 (21), 7–7–13. [2] With Smyth, Nisbet; with Smith, Hutchinson; with Morrieson, his bro. Hugh; with White, Hodgson. [3] DDn. 135 (5–6), 11–7–13. [4] ib. (14), 12–8–13. [5] B to CD. 7–8–13 (61–2). [6] Crawford to Mackenzie, 6–1–15, DDn. 131 (114–7). [7] CD to B. 16–6–15 (155). [8] BMC. 30–0–16 (64); DDn. 131 (200), 15–9–16.

Name	Corps		Number of Months employed 1811	1812	1813	1814	1815	Survey
Fleming	Engrs.	[18]	..	3	12	6	..	Murshidābād.
Franklin	Inf.	[51–2]	..	..	..	9	4½	Bundelkhand.
Garstin, E.	Engrs.	[41–2]	..	..	..	2	6	Nepāl War; Sabāthu.
Gerard	Inf.	[180]	..	3	..	12	..	Routes; Revenue Survey, Sahāranpur.
Hodgson	Inf.	[37–8, 40–2, 82–4]	..	..	9	12	12	Upper *Doāb*; Nepāl War; Sirmūr.
Hutchinson	Engrs.	[47, 90]	..	..	6	3	1½	Mirzāpur; Nepāl War.
Hyde	Inf.	[18, 296–7]	..	..	7	3	12	Calcutta; ASG.
Jackson	Inf.	[19]	..	..	..	8	..	Burdwān boundary.
Lawtie	Engrs.	[28, 90]	½	1½	½	2	..	Routes; Delhi; Nepāl War.
Lindesay	Engrs.	[43, 47]	..	1	1	4	3	Mirzāpur; Rewah; Gorakhpur; Nepāl War.
Lloyd	Inf.	[52–3]	Irregular periods					Routes Nāgpur.
Morrieson, H.	Inf.	[17–45]	..	4	7	3	1½	Mirzāpur; Sundarbans.
Morrieson, W.	Engrs.	[15–7]	8	12	12	9	..	Sundarbans.
Nisbet	Engrs.	[19]	..	3	3	..	..	Chota Nāgpur.
O'Donnell	Inf.	[47]	..	1	6½	..	..	Routes, Chota Nāgpur.
Paton	Engrs.	[41–2]	..	..	..	2	6	Nepāl War; Sirmūr.
Peckett	Engrs.	[19–25]	6	6	..	..	..	Cuttack; Patna–Gaya Road.
Pickersgill	Inf.	[38–40]	..	..	9	12	4	Nepāl Frontier.
Playfair[1]	Inf.		..	..	6	..	..	Benares Military Road 14–5 to 30–11–1813.
Raper	Inf.	[46–7]	..	..	2	6	..	Chota Nāgpur.
Rogers	Inf.	[47]	..	2½	..	..	..	Routes, Chota Nāgpur.
Sackville	Inf.	[24–5]	12	6	..	..	..	Cuttack.
Schalch	Inf.	[18]	..	..	5	4	..	Murshidābād.
Smith	Engrs.	[47]	..	..	6	5	..	Mirzāpur; Rewah.
Smyth	Engrs.	[45–6]	..	3	4½	..	..	Chota Nāgpur.
Stephen	Engrs.	[23, 25]	4	9	7	8	..	Cuttack; Benares.
Tickell	Engrs.	[35–6]	2	½	..	..	..	Allāhābād; Route to Rewah.
Todd	Inf.	[55 6]	3	6	5	..	..	Routes, Central India.
Webb	Inf.	[55–6]	8	½	..	..	8	Oudh & Gorakhpur; Kumaun.
White	Inf.	[33–4]	8	12	5	6	6	Upper *Doāb*; Calcutta.
Wilton	Engrs.	[18, 36–7] [21]	..	3	..	..	..	Berhampur; Ganges–Bhāgīrathi cut.

MADRAS

Madras surveyors of the early years of the 19th century fall into four main groups—Engineer officers, with the dominating figure of Colin Mackenzie—Three King's officers; the remarkable genius William Lambton; the scientist Kater [pl. 21]; and the French emigré Warren [pl. 23]—numerous Cavalry and Infantry officers, mostly trained at the Military Institution under the Austrian soldier Anthony Troyer—the civilian establishment of Assistant Surveyors, born and bred in the country, and trained at the observatory school.

The surveyor whom Mackenzie trusted most was the Scotch graduate Mather, who had made his name on the survey of Bāramahāl [I, 113–4] and had to resign owing to ill-health in 1806. His other officers in Mysore were Warren, who transferred to Lambton's survey in 1802; Arthur, of the Engineers, who left under a cloud in 1805 and afterwards held charge of the survey of Travancore; and Morison, of the Artillery, who replaced Warren. Arthur kept up a most interesting journal[2] and has left delightful accounts of the country and of survey life in Mysore [208, 361]. Early in 1803 Morison was called away for military service against the Marāthas and never rejoined. He had a distinguished career in after years, and Mackenzie was very pleased for him to act as Surveyor General whilst he himself was absent on the Java expedition.

It was only seldom, and for short periods, that engineer officers could be spared for survey duties. De Havilland spent about a year as Engineer and Surveyor with the Nizām's subsidiary force, a post that Mackenzie had first held from 1792 [I, 112; II, 132]. Blair made a start on the survey of Travancore, and was then

[1] Supt. Mil. Roads, 1813–8. [2] *v.* Bio. Notes and GBO. Lib. A b. 85.

moved to relieve De Havilland in the Deccan, but his contribution to geography was small. Johnson of the Bombay Engineers was employed for a few months on the survey of North Kanara, but was soon called away for urgent engineer duties [97], as indeed Mackenzie had rather expected ;

> Your fondness for this line would have induced me long ago to suggest your being employed, did I not apprehend that the duties of the Engineer would not have admitted your being detached, and they seem to think here that too many of our Corps are already detached on it[1].

The general shortage of engineer officers in the Presidency led General Hewett to recommend the withdrawal of Arthur and Blair from survey charges[2]. The only other engineer officer employed for long was Thomas Davies, surveyor to Colonel Dowse's force in the South Marātha campaign from 1812 to 1814 [166], and later in the Marātha war.

The employment of King's officers on civil duties was altogether contrary to the Company's policy. Lambton had, however, soon established himself as indispensable, and special authority was readily granted for him to continue his survey after his regiment had left India [304–5]. Kater's health broke down before he had completed three years with Lambton, and he won fame in the scientific world after his return to England. Warren's appointment to act as Astronomer was much disliked by the Directors, even though it was pointed out that, except for Lambton, there was no other possible selection;

> We are concerned to find ourselves under the necessity of withholding our approbation from this appointment. We wish to regard the officers of His Majesty's service employed in India with respect and liberality, but, independent of command and employments strictly and purely military, ... we consider all situations and offices under our Governments as appertaining to our servants, civil or military, who have nothing else to look to. If Mr. Goldingham should return to his station, this temporary substitution is of little consequence, otherwise than as it touches upon a principle which we must maintain as in itself important ; but if it should become necessary to appoint a regular successor to the office, we must desire, without meaning the least disparagement to Lieutenant Warren, that the successor be taken from our own servants[3].

In spite of this protest, Warren continued to act until his resignation at the end of 1811.

The Corps of Guides which had provided so many valuable surveyors since the early days of John Pringle [I, 95–7] was, from 1800 to 1803, commanded by James Colebrooke, brother to the Surveyor General of Bengal [122–3], and then by Blacker who in 1806 was absorbed with the Guides into the Quartermaster General's department ;

> The Corps of Guides, during a length of time after its establishment, was unconnected with the department of the Quarter Master General of the Army. The late Commander-in-Chief, perceiving the disadvantages which attended the separation, ... annexed the Guides to the Quarter Master General's office, but continued the situation and the allowance of the Captain of the Guides, and appointed that officer to be Assistant Quarter Master General[4].

It was later ruled that the A.Q.M.G. should only draw the extra allowance of Captain of Guides when actually employed on survey, and the allowance was finally abolished in 1810 [301].

A full account of the Military Institution is given later, and that of the civil assistant surveyors is kept for another chapter.

During 1809 there broke out an extraordinary mutiny of the officers of the Madras Army, who had long been most discontented from a multitude of causes[5]. There had been a series of undignified disputes between the Commander-in-Chief and the Government, senior military officers had been placed under arrest[6], and in May 1809 the British officers of native units throughout the Presidency went into open mutiny, defying orders, and placing under arrest any senior officer who refused to join. At Seringapatam the mutinous officers gained control of the treasury, siezed a consignment of treasure on the road, and held the fort.

[1] DDn. 66, 17–12–02. [2] Report, 27–0–10 (36, 245); DDn. 84 (15–9). [3] CD to M. 9–4–06 (26) [4] Minute by C-in-C. : MMC. 27–10–06. [5] Full account in Cardew's "*The White Mutiny*". [6] including the QMG., Col. John Munro [265].

The King's regiments stood loyal to Government, and in several places there was actual fighting between Madras regiments and King's troops[1].

In July the Governor called on all Madras officers to sign a *test* declaration, disclaiming allegiance with the mutineers; those who refused to sign were relieved by officers from King's regiments. In the whole Presidency less than 150 officers signed this *test*. The remainder, over 1,300, were removed to a station on the coast, placed under arrest, and the leaders courtmartialed. By the end of August the mutiny had been suppressed, and the Governor General, Lord Minto, came down to Fort St. George to make personal investigation. After 21 of the leaders had been dismissed by sentence of courtmartial, an amnesty was granted to the remainder.

> The officers who sat on the Courts-martial had far too much sympathy with the mutineers to sentence them to Capital Punishment. ... Officers who had supported the Government, or who had signed the test, were subjected to a considerable amount of petty persecution, being sent to Coventry and excluded from all social life[2].

In the end, the majority of the 21 dismissed leaders were restored to the service, amongst these being De Havilland, one of the ringleaders at Seringapatam, who was reinstated in 1814. Several of the 18 officers of the 4th class at the Military Institution, who were sent back to their corps in February 1809 for irregular conduct, subsequently became useful surveyors [318, 321]. Mackenzie and a very few surveyors signed the *test*.

Lord Minto remained in Madras till April 1810, but before he left determined that "Regular and steady discipline must certainly be restored, or rather created, for it never existed here. ... Discipline *must* be enforced". He therefore summoned the Commander-in-Chief, Sir George Hewett, from Bengal [160];

> His authority, which is the highest military authority in India, will be respected. He is... firm, temperate, and judicious. ... I shall wait for him here, and leave him in charge without anxiety when we have thoroughly compared ideas[3].

Hewett made a thorough investigation of the conditions of the Madras army from all points of view, and put up proposals for its complete reorganization. His report, submitted on August 27th[4], went into every detail in a masterly manner, and amongst his recommendations was one for a Surveyor General to release the Quartermaster General from all responsibility for surveys, except those of a purely military nature for which he would be allowed a small staff [321–2].

His recommendations were promptly put into effect, and had far-reaching results. Amongst the orders issued was one that no officer was to be employed on survey or other departmental duties until he had served at least two years with his military unit [322–3], and this involved the withdrawal of officers attached to Lambton's survey [246, 322], the Goa and Travancore surveys, besides others employed immediately under the Quartermaster General [132, 134]. Exemptions were made in the case of Ward, recalled to the Surveyor General's office early in 1811 [303], and Garling, left in charge of the Goa survey.

At the instance of Garling the excellent practice was introduced of having a second military officer posted to each survey party. He obtained the services of Conner for the Sonda survey on pointing out that it was

> very desirable that another Officer should be appointed a temporary Assistant in the Department. ... It would provide for the due execution of the survey, and for the efficient direction of the services of the Sub-Assistants, in the event of the Superintendent suffering at any time from sickness in that unhealthy climate, (and) would also by a proper application of their joint labors facilitate the conclusion of the work[5].

MADRAS MILITARY INSTITUTION

In recommending the establishment of a school of survey for young officers [124–5], Lord William Bentinck wrote;

[1] About 400 sepoys were killed in fighting near Seringapatam. [2] Cardew (139). [3] Minto (226). [4] DDn. 84 (15–9). [5] MPC. 21–9–13.

Further measures...appear...to be necessary for acquiring a topographical knowledge of this Country, ... and to obtain a greater number of persons qualified for such pursuits is the first step which must be taken. ... The individuals composing the Corps of Engineers under this Presidency may be presumed to be qualified, ... but their numbers are inadequate, and ample employment is already found for them in their immediate line of service; other means therefore must be provided...by the further improvement of the Institution of Cadets established at Trippasore [308]. ...

I propose therefore that a select number of the Gentlemen Cadets at Tripassore shall be instructed in the art of forming topographical surveys, and that such of them shall be selected as may appear from their former education, or better natural capacity, to be more qualified for scientific pursuits[1].

Troyer was selected as Instructor in "geometry, drawing, and other branches of Military education", and regulations were drawn up[2];

The establishment will for the present be limited to twelve Gentlemen, selected from such officers lately promoted from the company of Gentlemen Cadets as are desirous to participate. ...

Quarters will be provided in Fort Saint George, and a mess established. ... Each Member of the Institution must be a member of the mess, and must reside in the Quarters allotted to him, from which he must never be absent at the regulated hours of study, or after 11 o'clock at night, without first asking and obtaining permission from the Town Major.

The Town Major was to be responsible for discipline and for giving instruction in garrison duties. A time-table was fixed;

They will rise at break of day, when a certain proportion will attend the lunge of the... Governor's Body Guard, to be instructed in Horsemanship, and those not employed thus...will frequently attend the parade at Guard mounting. ...

Breakfast will be served at eight o'clock.

The hours of instruction are fixed from 9 o'clock in the forenoon until one o'clock in the afternoon, two hours being allotted to the study of mathematics, and two to military drawing. ... Practical exercises of Geometry on the ground will be occasionally given, either in the morning before 7 o'clock, or during the coolest hours of the afternoon.

The remainder of the day will be at the disposal of the Gentlemen...for the acquirement of the languages of India, for their improvement in general knowledge, and for such recreation as is not inconsistent with propriety of conduct; but the whole must retire to rest at, or before, 11 o'clock at night, unless leave of absence...had been previously obtained. ...

It appears almost unnecessary to add that exact propriety of dress, silence, and attention, during the hours of study, and decency of language and manners in every situation is indispensible, as these are justly expected from the character of Gentlemen distinguished by selection for...this Institution. ...

Geometry is to be taught with the particular view to topographical surveys. ... Algebra is to be laid aside, and...all the Geometrical propositions requisite for the purpose are to be explained and demonstrated without the aid of it. The elements of Euclid recommend themselves by simplicity; ... a proper selection must be made from them, of perhaps one hundred propositions, which are to be a sufficient foundation for all the practical problems of drawing and surveying with a plain table; a thorough knowledge of the elementary part may require on an average an application of some months; the rest of the year would be given to the practical part, which for the most is to be taught on the ground. ...

The Gentlemen must dispose of some hours of the day for learning one of the Native languages and other duties of their profession, nor has the influence of the climate been forgotten, which admits of less exertion in general, and allows but few hours of the day for an exercise in the field. ...

As drawing and surveying are intended to be subservient to other important objects of Tactics in general, a proper application of them to several military duties is to be shown to the Gentlemen. They must be shown how to sketch a road, a ground which they reconnoitre...chiefly without instruments at all, on foot, on Horseback.

Troyer, who had doubtless been consulted about this syllabus, was an officer of Bentinck's staff. He had been in the Austrian army, had passed through the military academy at Wiener-Neustadt, and had been employed for some time on military surveys in north Italy. In advising the Directors of the establishment of this Institution, the Madras Government write;

[1] MMC. 29–9–04. [2] ib. 17–11–04.

Our President laid before us the Regulations which he proposed to establish for the management of the Institution, the immediate superintendence of which His Lordship for the present has taken upon himself. ...

His Lordship at the same time communicated to us a paper detailing the plan of teaching intended to be pursued by the Mathematical Instructor, together with various specimens of Military Drawing by that Gentleman. Similar sketches will be forwarded to your Honorable Court with this dispatch, and We trust that they will impress you with a favorable opinion of the qualifications of Ensign Troyer[1].

The first class of twelve assembled in April 1805, and a year later Troyer reported that they

have now all completed the survey, in the environs of Madras, of twenty-seven square miles each [125, 128]. ... As upon this occasion the Gentlemen were obliged to undergo considerable expence, they may be...allowed full Batta for the whole time in which they were employed, which is from the 20th of January to the 20th of April. ...

I dare hope that the specimens of their work, ... as soon as the more elaborate copies shall have been finished, will prove to your Lordship that their efforts as to accuracy have been attended with all the success which the great imperfection of their instruments would admit[2].

The grant of full batta was allowed.

When the second class, 18 strong, joined in April 1806, Garling, of the first class, was appointed assistant instructor

upon a salary of fifty Pagodas per month. ... Resolved that forty Pagodas per month be allowed for a place of instruction for the Senior Class. This will form the only Additional expence in adding a second class to the institution. The Senior class will find their own Quarters out of their Tent allowance ; the junior class will be lodged in the house occupied by the senior.

I had intended [continues Bentinck] to have offer'd the great room at the Government Gardens as a place of Assembly for the senior class, which would have saved the expence here proposed, But I found many objections to the arrangement. The Cadets, having neither palanquins or Bandies, would have been exposed unnecessarily to the sun, both in going and returning. The carriage of their instruments and papers would have been attended with some difficulty, from their very limited establishment of servants, and the meal of the middle of the day, which could not have been taken but at their own quarters, would have interferred materially with their studies. The room itself, which is highly finished, would not have much benefitted by Tenants of this description[3].

In October 1806 Troyer made the following report for the half year[4] ;

The first object of the Military Institution having been confined to such instructions as might enable the young officers to survey topographically, and to be Assistants in more extensive surveys, a selection of Theorems was made for that purpose ; the application of them with respect to surveying was shown...not without practical exercises, with all the instruments which it was possible to procure. ...

Military drawing was at the same time practiced, of which the specimens exhibited every month to your Lordship showed the gradual progress of each Gentleman. ...

As the application and progress of the Gentlemen had gained upon time and expectation in the first four months, the instruction was extended to the doctrine of planes and solids, the logarithmic calculations, and plane trigonometry. Besides this, another study having a nearer connection with military science was begun, namely field fortification. ...

I cannot omit here acknowledging the zealous application and capacity which Lieutenant Garling, my Assistant, has displayed in the instruction of the Junior Class.

Meanwhile the senior, after having completed the mentioned survey, were shewn the more extensive trigonometrical operations. The reducing and finishing of the plans of their respective surveys filled the hours usually allotted to drawing[5].

From November 1806 the senior class was authorized to draw survey allowance in addition to *batta* and horse allowance whilst employed "as regular surveyors".

At the end of May 1807 Troyer reviewed the first two years work of the Institution, and proposed a more ambitious syllabus for the future, including a regular survey of the Carnatic. At the same time he asked for orders as to the future employment of the senior class ;

The thirty officers at present comprising the two classes of the Military Institution have

[1] M to CD. 8–3–05 (157). [2] MMC. 13–5–06. [3] ib. 22–4–06. [4] His English improves as the years pass. [5] MMC. 21–10–06.

all qualified themselves for being employed on topographical survey, and the twelve of the senior class may be entrusted with a trigonometrical operation of some extent. ...

Major Lambton's survey, altho' moving in the sphere of higher science, admits yet...of the immediate employment of a number of Officers of the Institution under the Major's immediate guidance. ... Your Lordship has fixed the number of these Officers to be for the present three or four[1].

Bentinck was anxious that all twelve officers should be sent out on surveys at once, but the Commander-in-Chief insisted that they should first do a spell of duty with their units and, as both were relieved of office during the year on account of the Vellore mutiny [135 n ; 4], Troyer raised the subject again in October, pointing out that,

as a part of the Officers are to be attached to Major Lambton, who is upon the point of leaving Madras for beginning a new series of triangles from Cuddalore towards the South [241–2], they would by going to their corps lose the opportunity of joining him immediately. ... Major Lambton will best be able to state in how much their setting out with him might be convenient with respect to their instruction and his intended operations[2].

Troyer's proposals were circulated to Lambton, Warren, and the Quartermaster General, and as a result of their advice his syllabus was approved, and instead of being sent to their units the officers of the senior class were distributed—

four...to the General Survey under Captain Lambton—two to the Quarter Master General's Department—and...the remainder...on other surveys, as proposed by the Quarter Master General[3],

these being the surveys of Travancore [131–2], and of the Nizām's territories [134][4].

The opportunity was now taken to transfer control of the Institution to the Quartermaster General, whilst Troyer was appointed A.Q.M.G., with full disciplinary powers, as recommended by Petrie who was acting as Governor pending the arrival of Sir George Barlow from Bengal ;

It is of the greatest importance to the interests of the Military Institution that a plan of strict discipline should be united with the system of instruction. ... But a plan of discipline to be efficient must be direct and immediate. It must be conducted by a person who will be always present at the Institution ; who, having constant occasions of communicating with the young gentlemen, will be able to exercise an uninterrupted and continued system of...controul. ... Neither the Town Major nor the Quarter Master General can be vested therefore with the charge of maintaining the immediate discipline, ... and that duty must be entrusted either to a separate officer who will reside always at the Institution, or to...Captain Troyer. ...

The plan proposed...appears...to accomplish the intended purpose by giving the appointment of Assistant to the Quarter Master General to Captain Troyer, and placing the Institution under the Quarter Master General's department. The necessary degree of authority will be communicated to the instructor, supported by all the weight of the Qr.Mr.Genl.'s department. ... Neither do any objections exist against that arrangement on the grounds of the late order from Europe regarding King's Officers [313] ; Captain Troyer holds an appointment already in the Company's service under the santion and approbation of the Honorable Court of Directors. ...

The subject is of considerable importance. ... Unless the young Gentlemen at the Institution are subject to a regular system of discipline, there are reasons for apprehending that they may acquire habits of disregard for authority, of insubordination, and perhaps of licentiousness, totally incompatible with the military character ; ... the general irregularity of conduct... imputed to some of them has produced impressions unfavorable to the whole plan of the Institution. Captain Troyer, supported by the constant Assistance of the Quarter Master General's office, ... will be able to establish a degree of order, regularity, and propriety of conduct among the young Gentlemen, which will materially conduce to the improvement of the Institution, and obliterate the only objections which have been urged against it. ...

Talents, assiduity, and regularity of conduct, divested of rank or age, are not always sufficient to give that weight to which a young mind will readily yield. This difficulty no doubt struck forcibly the late Governor, when he appointed the present mathematical Instructor, ... a Gentleman whom experience has certainly shown to be fully deserving of the trust

[1] MMC. 1–12–07. [2] ib. ; letter of 6–10–07. [3] With Lambton, Bayley, Chavasse, Tulloch, Swinton : with QMG., Raester, Walpole to Travancore, Biss, Harris, Dalgairns : to Hyderābād, Burnett, O'Donnoghue
[4] MMC. 4–12–07.

placed in him, but who, from his recent admission in the British army, and inadequate knowledge of the system of its service, probably declined the task of uniting military command with the other branches of his avocation. Every praise is no doubt due to Captain Troyer for the universal satisfaction which he seems to have given to the Gentlemen who were placed under his tuition, but probably he would not have been less fortunate had he, at the period of his first appointment, been invested with more extensive authority. ...

As in the present instance no increase of establishment can possibly be admitted, Captain Troyer is the only person in whom this authority might be vested without inconveniency. ... His salary as Instructor being sufficiently handsome, he may well perform the duty of Assistant Quarter Master General without claiming any additional allowances. This appointment, placing him ostensibly under the first public officer of the army, will no doubt (combined with the mildness of his manners) give him sufficient weight to maintain discipline without much reference to his principal[1].

It was no fault of Troyer's that the prevailing spirit of unrest infected the Institution. Bevan records that "towards the middle of 1809 the Military Institution was suspended by Government" till the mutiny was settled[2] [314]. General Hewett found, however, that the Institution was well worthy to be continued ;

Of the advantages of this establishment...I can entertain no doubt; ... it is at present confided to hands in every way qualified.

I am therefore a warm advocate for the continuance of an establishment so apparently well calculated to diffuse a general spirit of military study and improvement among the officers of the army, stimulated as they will be if proficiency at the institution is found to lead to preferment in the more scientific branches of the general staff.

He objected however to

beginning at the wrong end, teaching young men the higher walks of military science before they are acquainted with the first duty of an Ensign. ... I shall, therefore, submit the propriety of not admitting officers to the benefit of the Institution who have not previously served a term of 3 years with their corps, and who cannot produce certificates...that they possess a perfect knowledge of the Hindostannee language. ...

The Government, for the purpose of encouraging the progress of the Institution, granted very liberal allowances to these young men, and with the same view appointed the whole of the first class soon afterwards to the principal surveys [317]. ... Most of these officers are still employed in the same manner, and several others selected from the succeeding classes of the Institution have also been appointed to surveys.

The whole number actually employed amounts to 23, including one lately appointed to the Institution, and the salaries of all of them remain the same as was first established. Most of these young men have never joined corps, and have not been longer than three or four years in the service. Their employment upon surveys should be considered as a means of completing their Military education at the Institution, and should not entitle them to greater allowances than are sufficient to cover their unavoidable expenses[3].

The following order was accordingly embodied in the regulations ;

The officers at present attached to the Institution, who have not joined the Army since the commencement of their service, will, at the expiration of 2 years from the time of their having begun their studies, be directed to join their Corps, and when they shall have served for the space of two years and obtained from their Commanding Officers the certificate prescribed, ... they will be considered eligible to be employed in the department of the Surveyor General, or that of the Quarter Master General[4].

From 1813 it was further ruled that "no officer shall be appointed to the Military Institution who has not done duty with his Corps for the period of three years"[5].

As regards future administration, Government ordered

that the Superintendence of the Military Institution should rest with the Commander-in-Chief, who will no doubt avail himself of such of the offices the General Staff as he may think proper for that purpose, but...all surveys...be made...in Communication with the Surveyor General, that that officer be enabled...to direct the employment of the students...as may be most conducive to the General objects of the Department ; and the Governor General in Council is also desirous that the result of their labours be forwarded to the Surveyor General[6].

In his proposals for field season 1811–12, the Quartermaster General reports that the students

[1] MMC. 18–12–07. [2] Bevan, I. [3] DDn. 84 (93), 27–8–10. [4] MGO. 9–10–10 (5). [5] MMC. 29–10–13. [6] ib. 29–1–11.

commenced their studies in the month of March 1810, and will...have completed the two years of instruction...a few months hence. ... Two tours of field survey are absolutely necessary to confirm their practice, and gain the full benefit of their lectures. ... It requires six months, calculated from the first of January, when the surveying season commences, to complete the field operations and subsequent drawing of the plans, and...it will be for the good of the service to permit the officers to prosecute their studies until the 1st of July next. ...

In forming the next class, by assembling them on the 1st of July instead of at an earlier period, the advantages of two field practices will be secured without exceeding the period of two years attendance[1].

As Garling was now on survey in Goa, his place as assistant instructor was from May 1811 taken by Walpole, also of the first class, and in October it was pointed out that Walpole, "from delicacy towards Lieutenant Garling", had not drawn allowances for the post. A separate allowance was therefore granted to Garling for charge of the Goa survey, leaving Walpole those of assistant instructor, [332] a second assistant, Cameron, being sanctioned in 1812.

From July 1812 Montgomerie and Mountford were employed on compiling the survey into general maps [129, pl. 12], and this brought up the question of permanent accommodation ;

The house lately occupied by the Military Institution, which was taken for them at the Rent of 90 Pagodas per month[2], ... was vacated by them on the 1st instant, when they proceeded on Field Practice. ...

Cornet Montgomerie and Ensign Mountford, employed in the reduction of former surveys, continue to occupy quarters in the same house. Hitherto the House Rent for the Military Institution has ceased when the Officers have been sent on Field Practice ; but material inconvenience has arisen from this arrangement, in consequence of the frequent difficulty of procuring a suitable House on their return to the Presidency. The only remedy would appear to be ...an arrangement by which it could be engaged for a certain number of years. ...

Twelve officers only...can be accommodated, and eight were obliged to provide quarters for themselves at St. Thomé, paying each from 7 to 10 Pagodas a month house rent. The house...has been lately purchased by a Native, who has offered to build additional accommodation...in case the rent of 100 Pagodas per month be secured to him for 5 years. ...

It would remove the inconvenience which has been annually experienced ; ... it would likewise place all the Officers on an equal footing, secure their residing near the place of their studies, besides removing the necessity of a certain number getting in debt from their incapability of defraying both their mess bill and house rent at the Presidency out of Ensign's Pay[3].

The original system of taking in one class every year, and maintaining a senior and a junior class in residence at the same time, had been changed after 1810, but was again brought in from 1813 on the Quartermaster General's recommendation that it will be more expedient to admit 10 Students each year than 20 every second year. ... As the period of study of the present class of 20 Members will not be completed until the 1st of July 1814, the proposed measure will have the effect of placing 10 additional Officers at the Institution during one year[4].

The lease of the residential building for five years was sanctioned, but for the new class

the owner of the Garden in the vicinity of the Institution Buildings had engaged to let the same ...from the 1st July. No written Engagement having been taken, ... the owner lately accepted the offer of a more desirable Tenant, and there is now no House of sufficient accommodation, conveniently situated, to be had for 50 Pagodas per Month. In this predicament a Native Maistree has offered to construct 10 frame-work Bungalos, roofed and walled with mats and thatch, at a less expence than the amount of 12 months rent, and that they shall be perfectly Waterproof and comfortable.

The suggestion was approved[5].

The Institution was closed down in 1816, as the Directors had by then made satisfactory arrangements for their cadets at home[6], and found that there was no need to incur the expense of their further education at Madras[7]. In a vain protest Sir Thomas Hislop [280 n.5] recorded some of the achievements of students ;

[1] DDn. 127 (122), 22–11–11. [2] MMC. 29–3–11. [3] ib. 29–1–13. [4] ib. 30–4–13. [5] ib. 22–6–13. [6] Addiscombe now available for infantry and cavalry [308]. [7] MGO. (G), 17–4–16, MMC. 15–6–16.

In the same year [1810] the expeditions against the Isles of Bourbon and Mauritius were fitted out, and each had its proportion of Officers from the Institution. They were employed on the fall of these Islands in surveying them and their Coasts ; and I believe that copies of these surveys were sent to England.

On the expedition to Java 6 Officers were attached to His Majesty's Regiments to do duty with them until their services in their own particular line should be called for. So soon as that settlement was taken they were found so generally intelligent and useful that they were employed on other duties. Lieutenant Jordan was appointed a Resident ; Lieutenant Hanson, Secretary to the Commander of the Forces ; Lieutenant Dalgarnes, to command the Malay Corps ; Lieutenant Stewart, to the command of the Pioneers ; Lieutenant Bayley, an Assistant Quarter Master General on the Island ; and Lieutenant Clode, Secretary to the Governor. This latter Officer was subsequently required to proceed in the capacity of Engineer with an Expedition to the Coast of Sumatra where, after constructing a Fort, he lost his life from the effects of fever[1].

Though no confirmation has been found for Markham's statement that "it was Mackenzie who suggested the establishment of the Madras Military Institution" [124–5], yet he held a very high opinion of the training given by Troyer. In later years, when looking round for surveyors fit for charge of surveys, he writes ;

Mr. Montgomerie had the first claim to be employed ; afterwards Captain Jourdan, Captain O'Donoghue, & such of the gentlemen as were employed under Colonel Lambton in 1810, if they wish it, and such of as were on the Goa survey if they desire it ; there should be some remembrance of former services.

I could wish you to get me, if possible, a list of all the officers employed in the Military Institution from first to last. It might be right to advert to it some day[2].

For less immediate reasons such a list is now appended.

Class I[3]. Joined April 1st 1805.

J. Bayley	J. Dalgairns	J. C. Raester
W. Biss	J. Garling	J. Swinton
T. D. Burnett	W. Harris	A. Tulloch
W. Chavasse	J. J. O'Donnoghue	H. Walpole

Class II[4]. Joined April 1806.

E. Burges	J. Hanson	C. L. Nelthropp
C. G. Alves	H. G. Jourdan	J. Riddell
T. Clode	C. Kinsey	R. Simpson*
C. F. Colman	C. Lethbridge	A. Stewart
M. H. Davidson	J. Low	C. Swanston
C. Elderton	W. Murray	J. Torriano

Class III[5]. Joined June 1807.

D. Agnew	J. Fyfe	J. Perry
N. Alves	E. Y. Hancock	W. Robertson
J. Cameron	J. T. Hodge	R. Saunders
B. Christian	H. Kyd	G. Scott
P. E. Conner	J. Le Page	H. C. Woodward
H. G. S. Croasdaile	R. McGlashan	R. Young
C. D. Dunn	P. H. Newall	

Class IV[6]. Joined 13th February 1808 ; those marked* ordered to rejoin units, 18–2–09 [314].

R. Allan	G. Heath*	C. Snell*
W. Allan	R. H. Hodges*	A. E. Spicer*
W. H. Budd*	N. Macleod*	E. W. Stopford*
B. Christie*	R. Marklove*	J. W. Taylor*
M. Clarke*	W. Low*	W. R. Taylor*
T. P. Ball*	H. Moberly*	R. Williams*
C. St J. Grant*	W. N. Pace	
R. W. K. Hansard	H. W. Poole	

Class V[7]. Joined between December 1809 and March 1810 ; those of Classes V and later marked† had been nominated in March 1809, but were prevented from joining by the mutiny [314].

H. Bevan	J. S. Kinsey	F. Mountford
A. Borthwick	C. Kippen†	J. Sinclair
H. Boulton	C. Maxtone	W. R. Taylor
T. Clifford	A. Mackintosh	W. Tait

[1] Minute of 15–1–16 ; MMC. 29–3–16. [2] To Mountford, 4–3–19 ; DDn. 149 (49). [3] MMC. 10–4–07 ; *IO Cat.* (354). [4] MMC. 11–11–06. [5] MGO. 30–5–07. [6] ib. 13–12–08 & 18–2–09. [7] ib. 12–12–09. MMC. 10–12–11 & DDn. 127, 12–2–12.

Class V.—(Contd.)

J. H. Crisp†	E. Macpherson	J. T. Webb
L. Dinwiddie	J. G. Mitford	A. Williams
H. S. Gale	D. Montgomerie	
A. Grierson	F. W. Morgan	

Class VI[1]. Joined 1st July 1812.

E. J. Ellaway†	D. MacQueen	T. Robson
J. Glas(s)	H. Massey	C. F. Smith
W. Hamilton	H. N. Noble	A. E. Spicer
H. Harris	H. W. Poole	W. Strahan
G. J. Horn	G. Payne or J. Payne	A. Truman†
G. Lee	W. N. Pace	H. White

Class VII[2]. Joined July 1813.

W. N. Burns	A. M. Campbell	S. Hughes
H. O. Butts	J. J. Hammond	G. Sharp
H. W. Byrn	R. H. Hodges	C. Sinclair

Class VIII[3]. Joined July 1814.

J. W. Cleveland†	T. R. C. Mantell	J. W. Taylor
R. Cuxton	A. Mackintosh	J. Willows
H. Coyle	C. Snell	E. Woodhouse
J. Laurie	W. Stewart	

Class IX[4]. Joined July 1815 ; the last class admitted.

W. Cuningham	J. Macdonald	S. W. Steele
J. Gibbings	H. Mathews	W. Stokoe
R. Gibbings	V. Mathias	W. R. Thomson
J. Grimshaw		

Officers whose names appear in more than one class, had probably dropped out of their first one.

QUARTERMASTER GENERAL'S DEPARTMENT, MADRAS

In his original proposals for the Military Institution, Bentinck had foreshadowed the eventual employment of some of its officers to form a corps of surveyors under the Quartermaster General. From the first two classes six went to Travancore [131], two to Hyderābād [134], two to work in the Q.M.G.'s drawing office, and other on surveys of less importance.

In 1810, whilist recommending that all regular surveys should be transferred to the control of the Surveyor General, General Hewett suggested that

> a certain number of the officers educated at the Military Institution might still be employed under the Quarter Master General's Office in Surveying Routes, Passes, and such provinces as have been least explored. ... These officers might be divided into three classes, the salaries of the first, or Superintendents of Surveys, might consist of 70 Pagodas in addition to their full Batta ; those of the second class, of 37 Pagodas each, with their full Batta ; and the 3rd class of 25 Pagodas each, besides their full Batta ; but those salaries should cover all expences.
>
> The whole of the number to be employed upon this duty might be limited to twenty, to be selected by the Commander-in-Chief, as occasion required, from officers who had been educated at the Institution, and had served with corps[5].

The General Order giving sanction to these proposals provided that the first class should "consist of two officers, the second of eight, and the third class of ten"[6].

The same order directed that officers who had served less than two years with their military units should forthwith be posted back to military duty [314], an exception being made in the case of the Goa survey, where

> it would be disadvantageous to let the expense of their preparations become fruitless, and the present opportunity of effecting a desirable object lost. It has accordingly been determined to allow them to remain in the Goa territory until the survey of it shall have been completed. But as that survey is not of the particular nature described...as belonging to the department

[1] MGO. 19–3–12 ; MPC. 1–5–13 ; DDn. 132, 1–2–14. [2] *MAL.* 1–4–15 (122). [3] MGO. 6–5–14 ; *MAL.* April 1815 (122). [4] ib. Jan. 1816 (123). [5] DDn. 84 (93), 27–8–10. [6] MGO. 9–10–10 (15).

of the Quarter Master General, ... they shall prosecute the work under the direction of the Surveyor General[1].

The Quarter Master General recommended nine officers as fit to be graded in his new department, and to continue on survey in spite of not having served the prescribed period of regimental duty, but Government remained firm, and sanctioned the appointment of only two, Nelthropp and Davidson, who complied with the conditions. Davidson was transferred to the commissariat in 1813, and in the same year O'Donnoghue, Cameron, Stewart, and Dalgairns, were added to the establishment, which stood in March 1815[2];

Survey Branch;	1st Class—	O'Donnoghue;	Stewart.	
,,	2nd Class	Poole	Nelthropp	Dalgairns
		Swanstone	Cameron	Strahan
		White	Riddell	Hamilton

This separate survey branch was abolished shortly after, but many officers of the Q.M.G.'s staff did u eful work during the *pindāri* wars of 1816–8, and many of their field sections are preserved.

LAMBTON'S GENERAL SURVEY

From 1800 to 1802 Lambton worked singlehanded in Mysore, except for the companionship of James Colebrooke, Captain of Guides, who filled in some of the detail [236]. Lambton had already got into communication with Warren, his fellow-subaltern of H.M.'s 33rd Foot whose transfer was effected in October 1802 [117, 119]. He was, however, called away early in 1805 to relieve Goldingham as Astronomer [239, pl. 23].

Before starting triangulation across the peninsula in 1803, Lambton obtained the services of a second assistant, Henry Kater, of H.M.'s 12th Foot. Like Warren, Kater did valuable work running secondary triangles in advance and on the flanks, and sketching the main features of the country. Unfortunately his health broke down, and he returned to England early in 1806 [240, pl. 21].

At the end of 1807 four officers of the Military Institution were posted to Lambton's survey, which at the Commander-in-Chief's particular request was to provide a basis for future military surveys of the south peninsula [242]. The surveyors posted in December 1807 were Bayley, Chavasse, Swinton, and Tulloch; Chavasse and Tulloch being relieved later by Hodge and Riddell. In addition to running important series of principal and secondary triangles, and filling in with lesser triangles, they sketched in the main features of the country, and ran perambulator traverses along the roads.

Under the new orders issued at the end of 1810 [314] most of these officers had to revert to their military units, but Lambton was allowed to keep Riddell and Hodge for another twelve months. He had specially asked for Bayley, who was an excellent triangulator, but he was wanted for the Java expedition. Riddell, however, did noble service, being entrusted with the main triangles of the great central arc, and a longitudinal series to the east coast [245–6]. Amongst the arguments which Lambton urged in his efforts to keep Riddell and Hodge was the possibility of his having to accompany his regiment on its return to England [304–5];

> If I be alone, I shall not be able to finish the two coasts and carry the middle triangles into the Nizam's territories; whereas, if these gentlemen remain with me...I shall direct them to take different routes to the westward. ... I shall in the meantime recommence the meridional series...and proceed...to the banks of the Godavery, should the country be favourable. All this...will be performed before the setting in of the west monsoon in 1813, about which time I may know what the King's pleasure may be respecting my remaining in this country.
>
> With this publick object in view, ... Lieutenants Riddell and Hodge may be permitted to remain permanently attached to this survey. ... Lieutenant Riddell in particular has been at

[1] MMC. 29–1–11. [2] SG.'s Quarterly Return for 31–1–15; MPC. 17–3–15.

much pains to instruct himself in the theoretical principles necessary, ... and has, besides, had considerable experience on the higher practicle branches thereof [*sic*] And I have no doubt, from Lieutenant Hodge's zeal, of his soon becoming equally proficient[1].

Government, however, remained firm, and Lambton had to give up his military assistants from 1st December 1811, and continue with such help as his country-born assistants were able to give.

JAVA

Though several surveyors of the Institution sailed with the expedition to Java [320], no regular provision was made for military surveys, even though Mackenzie himself went as Chief Engineer. Surveys were, however, made by two King's officers, Thorn of H.M.'s 29th Light Dragoons, and William Colebrooke of the Royal Artillery, and by James Bayley of the Institution [135–7].

After the Lieutenant Governor had taken over full control of surveys [136–7], two Bengal officers were employed ; Baker, who belonged to one of the Light Infantry battalions raised from sepoys of the Bengal Army who volunteered for service in Java, and George Everest, serving with one of the Bengal Artillery units. Everest, as every one knows, became the most famous of all Indian surveyors, but we have no record of other surveys by Thorn, Colebrooke, or Baker.

BOMBAY

Moncrieff, of the Engineers, had been on survey in Malabar before 1795 when he was officially appointed Assistant Surveyor [I, 273]. In spite, however, of repeated appeals from Reynolds for his presence at Surat, he was too useful in Malabar to be released. In 1797 he raised the corps of Pioneers, and was fully occupied with surveys and road making. Saturated with fever, he was given a few months leave in 1801, which he spent helping with the great map at Surat, and, to Reynolds' infinite sorrow, died at Bombay on his way back to Malabar, [I, 357 ; II, 282].

Between 1801 and 1803 Reynolds succeeded in collecting a staff of three assistants ; Drummond of Engineers ; Sutherland, and Williams, both of whom had at one time been nominated for the same corps [305]. Williams who became the most notable of the three, had been second-in-command of the Pioneers under Moncrieff and done a good deal of survey in Malabar [I, 132].

After Reynolds' departure, Williams succeeded as Surveyor General [305–6], with Sutherland as assistant, whilst Nutt was brought in on Drummond's resignation [338]. In September 1808 Sutherland was called off to Persia with Harford Jones, and Nutt took sick leave overseas shortly after. For survey of Gujarāt and the western frontiers in 1809, Williams obtained Cruikshank, Byers, and Grindlay [171][2], whilst for his revenue survey of Broach, [188], he had Cruikshank Towsey, Ovans, Adams, Newport, Lenn, and Rochfort, all infantry officers. Sutherland returned early in 1814 and resumed his place as first assistant.

Dickinson, revenue surveyor of Bombay and Salsette had an establishment distinct from that of the Surveyor General [306]. Being himself an Engineer he collected his staff entirely from that corps. There were constant changes, but in 1814 he had Nutt and Remon on Rs. 250 each, and Jopp, Macleod, and Tate, on Rs. 120 each[3].

[1] DDn. 36 (272), 9–9–11. [2] Bo MC. 20–12–08 *et seq.* [3] Bo RC. 2–2–14.

CHAPTER XXIII

ALLOWANCES & EXPENDITURE

Surveyor Generals — Bengal Surveyors — Mysore Survey — Military Institution — Madras Surveyors, 1807–15 — Lambton's Survey — Lambton's Establishment & Expenditure — Survey Expenditure, Madras, 1810–5 — Bombay Surveyors.

IN 1785, as a measure of retrenchment after the long war against Mysore, the Surveyor General's salary, beyond regimental pay and allowances, was reduced from Rs. 1,000 to Rs. 500 a month [I, 274], and in 1800 Government refused Colebrooke's request for an increase [I, 275]. Though this rate was less than that drawn by a surveyor, viz. Rs. 618 a month, the Surveyor General drew all charges for establishment and office separately, whereas the surveyor had to provide not only his instruments, but all travelling and establishment charges as well, out of his salary.

In 1807, when Colebrooke went up country for the survey of the Upper Provinces, he drew "the boat allowance of his rank", Rs. 630 a month, which was "not to commence until the Surveyor General shall be prepared to proceed from Fort William". For this he had to give up the rent of the office and pay of the *durwān*, Rs. 94, and his house rent Rs. 120[1].

In 1811 Garstin made another unsuccessful attempt to have the salary increased, calling attention to the Directors' appreciation of "the high responsibility" of the office [289, 295];

> The importance of the situation being allowed by such high authority, I respectfully submit... the smallness of the salary, ... the allowances of the Surveyor General being by far the lowest of any similar appointment in the service ; much under those granted to the late Marine Surveyor General [296][2], and even less than those drawn by every surveyor employed in these provinces. How far it is inadequate to the responsibility attached, or to the labour and skill required, ... would be unbecoming in me to state. ...
>
> When my predecessor...was nominated to the appointment he flattered himself with the prospect of obtaining a remuneration for a long life of labour...from a publication of a General map, but it must be evident, by the orders issued from Europe, that all such emoluments (formerly so considerable)[3] are completely at an end. ...
>
> It is not only the ultimate promotion of this branch of the service but...there are no intermediate situations between the office of Surveyor General and Land Surveyor to recompense and encourage the exertions of the most deserving and labourious officers employed in it[4].

About three years later Crawford pressed the matter again ;

> When the present allowances were settled twenty eight years ago, our possessions were bounded by the Provinces of Benares and Balasore, since which period they have been extended nearly to the banks of the Kistna, Nerbudda, and Indus. ... Within these three last years, the Hon'ble Company have considerably increased the responsibility of the situation ; and it may be also worthy of remark that one half of the General Military appointments receive upwards of two thousand Rupees per mensem, and the other half upwards of three ; whilst the Surveyor General, who ought only to obtain the appointment after many years of hard labour to get the practice, and many years of study to get the Theory, in all its branches of Surveying, does not receive one fourth of the above allowance[5].

Government admitted "most fully the correctness and justice of the remarks", and asked the Directors to restore the salary to Rs. 1,000, but they had now decided

[1] BMC. 19–3–07 (111). [2] Officially styled *Marine Surveyor* [12, 296]. [3] Rennell was the only SG. to publish any of his maps, and his profits cannot have been *considerable* [I, 213–5, 227–9]. [4] DDn. 126 (74–6) 7–1–11. [5] DDn. 143 (7) 7–12–13 ; BMC. 18–12–13 (101).

to abolish the separate Surveyor General at each Presidency, and to substitute a single one for all India [306] ;

We deem the present salary and establishment of the Surveyor General at your Presidency, inclusive of the addition made to it in June 1808[1] and amounting altogether to Sa. Rupees 1,759–9–2, fully equal to what it will be necessary to allow for the salary and establishment of the Surveyor General of India, and that...a saving of expence will ensue nearly equal to the full establishment to be abolished at the subordinate Presidencies, together amounting to the equivalent salary and office establishment of nearly £ 5,000 sterling[2].

More generous counsels prevailed ;

Having taken into consideration the very extensive and important duties which...will be confided to the Surveyor General of India, to reside at Fort William. ... We hereby appoint him...with a salary of 1,500...sonat rupees per month, exclusive of the pay and batta of his rank[3].

Office establishment was drawn in addition.

In Madras, Mackenzie's pay on appointment to charge of the Mysore Survey had been fixed at 400 *pagodas*[4] a month "including incidental charges, but exclusive of the establishment of public servants" [330]. This was reduced to 200 *pagodas* in 1801, with permission to submit bills for contingent charges, but was again restored to 400 on his appointment as Surveyor General in 1810, with a further allowance of 150 *ps.* a month for writers and draughtsmen, and 50 for office rent[5].

Whilst acting in Mackenzie's absence Morison drew one third of this salary from November 1811, this being debited against the Java Government with whom Mackenzie had been detained [135][6]. It was only after long correspondence that Mackenzie was able to draw his allowance as Surveyor General for the full period that he was absent in Java and Bengal.

In Bombay, Reynolds appears to have drawn, besides regimental pay and allowances, staff pay as Surveyor General Rs. 702—establishment charges 876—and a special allowance from the Supreme Government, 800—totalling Rs. 2,378 a month [I, 282]. He drew, in addition, allowance for a draughtsman assistant, and pay and batta for his escort [I, 301–2], and finally the Directors allowed him a gratuity of two lakhs of rupees on completion of his map [I, 380].

On succeeding as Surveyor General, Williams drew the same staff pay, Rs. 702 a month, and establishment charges Rs. 750. For the survey of Gujarāt [170] he asked,

to enable him to meet the extra expence...of Horses, Cattle, and Camp equipage, as well as payments to the natives whom he must employ, that he be allowed an addition...of Rupees 750 a month, and that in event of this sum proving inadequate...he be permitted to charge for his further disbursements upon honour[7].

Though the extra field allowances were granted, further charges by contingent bills were not approved, and on a later application the Governor remarked that,

from Brevet Major Williams' letter, ... it would appear that he is in expectation of receiving some gratuity or reward for the execution of the duties confided to him, beyond the salary and emoluments attached to his office. ... I am willing to bear full testimony to the character and ability of Major Williams, but during the whole course of Service for which he claims additional Reward... he held the rank of Captain only, and...I am very doubtful how far his claim...can with propriety be admitted.

His personal salary as Surveyor General appears to be ...	Rs.	702		
with fixed allowances as follows ; viz.,				
Pay of his Regimental Rank, @ Rs.		120		
Gratuity		36		
Half Batta @ Rs. 3		90		
House Rent		50	998	
Additional Emoluments received while employed on the Western Frontiers :—				
The difference between half and full Batta, @ Rs. 3 ...	90			
The difference between House Rent and Tent Carriage ...	50			
Tent purchase at the rate of Rs. 800 every two years ...	33–01–33		173–01–33	
Total per mensem ...			1171–01–33	

[1] Increase of Rs. 340 to establishment allowance [272, 274]. [2] CD to B. 3–6–14 (25) ; DDn. 142 (4) ; The annual expenses were stated—Bengal £ 2,640—Madras 3,048—Bombay 4,909. [3] CD to B. 10–3–15 (1). [4] about Rs. 1,400, according to exchange. [5] DDn. 84 (9) 27–8–10 (250). [6] MPC. 16–2–16. [7] DDn. 82 (98) 27–12–08.

The additional Emoluments, namely Rs. 173–01–33, were...to be drawn up to the 30th of October 1810, when he was directed to discontinue the survey of the Western frontier, and...he preferred his claim to their continuance up to the time of his return to Bombay on the following grounds. First, that he could not reduce his additional establishment within the time limited, ... and secondly, from being employed on his way to Bombay in examining the Teak forests in the neighbourhood of Balsaur [168, pl. 15][1].

Under the orders of Government dated the 11th April 1811, the additional allowance of 750 rupees for establishment was continued to be paid up to the 1st May 1812, though his personal Emoluments of rupees 173–1–33 were withheld. ...

The examination of the Teak Forests was, in my opinion, a Service completely within the line of his duty as Surveyor General, to which station an established salary is annexed, and therefore no pretence whatever could exist for the continuance of any further allowance to him during the execution of the Service . ...

In the month of April 1811, Major Williams was appointed Revenue Surveyor with a personal salary annexed, in addition to this salary of Surveyor General, of 500 rupees per mensem [338], when the additional establishment of 750 rupees per mensem was reduced to 250 ; ... so that, subsequently to the 1st April 1811, his personal income, independent of establishment (including the Military pay and allowances), has amounted to rupees 1,498 per mensem[2].

Williams was accordingly called on for a "statement upon honor" of the particulars of his expenditure whilst employed "in Goelwar and Wallank" and in the teak forest, and replied that, when granted the fixed monthly allowance,

I understood it to be in lieu of all extra charge, and consquently I kept no account of the particulars of the expenditure at any period of the service. I can however affirm that from the commencement of it to the date of my return to the Presidency the allowance was not, one month with another, more than sufficient to cover the charge incidental to the undertaking.

The distribution...was to people...for procuring information, ... in providing and carrying extra camp equipage, instruments, and necessaries of all kinds, and in the measures that were indispensable for conciliating the Rajpoot & Cooly Thakores who occupy the Northern and Western confines of Guzerat and Waqur among whom my operations were principally carried on [171–2]. ...

Between the 31st of October 1810 and the day of my return to the Presidency, vizt. the 11th February 1811, ... the extra allowance of 750 rupees per month was discontinued, and I only drew my Garrison pay and allowance, including of course the Surveyor General's fixed establishment. From these...were to be disbursed...the charge of my field establishment of people, cattle, and camp equipage, as well as those of transporting all appurtenances of the office back from Guzerat to the Presidency; ... it really is not at present in my power to state in any but this general way the manner in which they were applied[3].

On his representing, at the time of his retirement, the great loss he suffered by the abolition of the office of Surveyor General, the Directors granted him a compensatory allowance of Rs. 200 a month from 1815[4], to be drawn in addition to salary as Revenue Surveyor.

BENGAL SURVEYORS

The allowances fixed for Bengal surveyors in 1785, [I, 277] were at the rate of Rs. 618 a month, except that during the rains, June 1st to September 15th, they were reduced to Rs. 250 on the ground that it would not then be necessary to maintain field establishments [327]. Assistant Surveyors were to draw Rs. 100 a month.

We have already referred to the difficulty of obtaining full allowances for field work carried out during the rains, or of drawing the reduced rates for more than 3½ months after close of work [I, 278 ; II, 219]. It was not till the end of 1807 that Thomas Wood obtained full payment for his survey through Rohilkhand and down the Ganges [I, 58–9]. He had completed field work between November 1799 and April 1800, and then spent till December 1801 protracting and mapping. Full allowances for the 5½ months field work were withheld till copies of fieldbooks were received, and the period for reduced rates was by special favour extended to

[1] Bulsār, 46 D/14. [2] Govr.'s minute, Bo MC. 4–10–15. [3] Bo MC. 25–10–15. [4] Williams, 14–8–21 ; Bo MC. 4–10–15 ; CD to Bo. 26–2–23 (2).

four months. On completion of his maps Wood claimed reduced allowances for a further period up to December 1801 ;

In the month of December 1801, by the desire of Marquis Wellesley[1] (whom I was ordered to attend at Allahabad), I forwarded to the Surveyor General my application...for the expected remuneration, but, after waiting patiently for four years and a half in hopes of an answer, no communication was ever made to me. ... Despairing...of any Notice being taken of it, I applied in May 1805 for the reduced allowances during the time I had been employed in finishing and copying my Survey, and...the rejection of my claim...mortified me in no small degree. ...

I have no hesitation in asserting...that what I surveyed in five months and ten days would have been satisfactorily received...as the work of ten months, exclusive of the protraction. ... My Bill is made out for fourteen months and a half, during which I most solemnly declare upon my honour I was employed upon this work on an average from four to six hours every day[2].

The Military Auditor General relented, and explained that he now saw for the first time letters from the Surveyor General saying that Wood's "exertions in conducing this Survey in so short a time as five months exceeded anything which he remember to have been performed by any Officer", and from the Commander-in-Chief saying that "after his Survey should be protracted his claims to further remuneration would be considered". He continued ;

Having inspected the draft of his Survey and also his Field Book, I cannot have any hesitation in stating that, had he been disposed, he might without subjecting himself to any censure have spun out his Survey at least for another year. ... Under these circumstances, I cannot have any hesitation in submitting the case...to the favourable consideration of your Lordship in Council.

The bill was at length passed on the Surveyor General's comment that

the sum drawn...under the head of reduced allowances...for protracting the said Survey, viz., Sont. Rupees 3,625, does not appear to me to be more than an adequate remuneration for the trouble and time which he expended[3].

Extra allowances as for " a Surveyor of Rivers", Rs. 240 a month during the field season only, were allowed in the Sundarbans, and on other surveys which entailed the upkeep of boats [I, 277 ; II, 14]. Engineer officers employed on the survey of cantonments were allowed only Rs. 100 a month, but were provided with instruments and establishment at Government expense [329][4].

These rigid regulations continued to put individual surveyors to heavy loss, and drew frequent remonstrances. The Surveyor General asked for a relaxation on behalf of White, on survey through the Delhi hot weather ;

Although by an old Regulation...surveyors are to be called in during the rainy season, and this rule has been always observed in Bengal, yet...such a regulation cannot be necessary for the higher parts of the country, where the rains are neither so heavy, nor last so long, as in Bengal and Bahar, and where also from the higher level of the country and the nature of the soil the water is drained off much sooner.

I hope therefore that no objection will be made to Lieutenant White's drawing his allowance for the month of July[5].

In 1805 it was ruled that " the allowances of Surveyors are not admissable subsequent to the actual period of the Survey "[6], and in the following letter the Surveyor General points out to White the effect of this rule, explaining incidentally why Wood's claim had been so long refused ;

I shall...recommend...that you may be indulged with some allowance for protracting the maps after the cessation of the appointment, though...none is allowed by the regulation, ... as it is supposed then that all the extra servants and people have been discharged. This, I believe, is the principle on which the allowance is given, and it is granted in the rainy season, not for the trouble of protracting the survey, but to pay the extra people who are supposed to be kept in pay when a survey is to be resumed on the recommencement of the dry season, as was the case with yours last year.

I know that neither Captain Wood, nor Lieut. Smyth of the Engineers, could get any allowance of that kind after their appointments had ceased without a particular application, and it was only granted to the former, ... for a short time[7].

[1] Governor General, 1798–1805 [I, 264 n. 6]. [2] BMC. 14–12–07 (15). [3] MMC. 14–12–07 (14, 17).
[4] BMC. 25–11–02 & 6–6–00 (61). [5] DDn. 81 (18) 6–9–06. [6] BMC. 6–6–05. [7] DDn. 81 (77) 4–5–07.

For one reason or another it was often a long time before salary bills could be cashed, and on one occasion White complained of

want of cash to defray the expenses of my establishment, etc., having been under the necessity of borrowing three thousand rupees from the Sharaffs[1] at Delhi for that purpose, when my allowances as surveyor are no less than ten months in arrears[2].

Both Tod and Lloyd, with the Residency escorts at Gwalior and Nāgpur, were allowed Rs. 100 a month for their route surveys; but though Lloyd was later allowed to draw this allowance without submitting regular fieldbooks, Tod was not so exempt, and the Surveyor General writes to him;

The map...of your Route from Agra to Saugor is just arrived [55]; as soon as your Field Book makes its appearance, certificate shall be sent to you, and I shall take an early opportunity of showing your map, both to the Right Hon'ble the Governor General and Mr. Henry Colebrooke, and giving the testimony in favour of your labours I think they well deserve. This is all that I have the power of doing; but from the experience of many years service I can assert that no person who makes exertions for the public benefit (though they may not obtain the remuneration for their labour so soon as they expect) is ultimately disappointed of it, and I would therefore recommend you to persevere in your researches; they will obtain you reputation, and wealth follows good fame as certainly as the shadow does the substance[3].

He reports to Government that Tod

has employed several Hircarahs to visit places to which he could not gain access [55], and has certainly been at a much greater expense than the allowance of 100 Rupees a month for keeping a route will defray. ... Lieutenant Lloyd has furnished the Field Books. These two officers have taken great pains to render their works correct; they seem to have made good use of the opportunity afforded them. ... I...submit...that these Gentlemen be allowed to draw half surveyor's allowances, ... or such other recompense as Government may think proper[4].

To Tod, who had complained of audit objections and delays, Garstin writes;

The Military Auditor General, who is guided by regulations alone and not by the evident justice or the propriety of the case, will object to your bill. There are certain forms of office which he cannot dispense with. ... I have laid the business before Government stating your services in the most favourable terms, and have recommended that an addition should be made to your allowances. ... If more had been applied for, probably none would be given, for there never was before so rigid a system of economy observed; indeed it was never so necessary. If persevered in for five or six years, and we remain at peace, the Company's affairs will be re-established; if not, they must be ruined, and from whence is our pay and Batta to come ?[5] ...

As Garstin probably foresaw, the Government reply was not favourable;

Those officers appear to have been very laudably and successfully employed, but...they have received an appropriate remuneration, both of them having a clear allowance of 100 Rupees per mensem, with permission to charge their contingent expenses to Government. His Lordship in Council does not think it necessary therefore to grant them any additional allowance or other reward at present.

As...Lieutenant Tod is employed in constructing a map of the country lying between the Nerbudda and the Jumna, ... His Lordship in Council will, on receiving that work, take into consideration the expediency of granting him a suitable remuneration[6].

Tod asked what expenditure might be fairly charged;

In collecting routes and sending Cossids [I, 286] for that purpose, I have paid many small sums and, as there is great danger, to those from Marwar[7] especially, were it known the information they afforded me, every route from place to place has cost me 8, 10, or 12 Rs. On quitting the Residency and travelling alone through the country, I am of course subject to much additional charge from living at my own expense, and additional equipage and carriage, and in passing through the different States I found my progress much facilitated by presents, which procured me additional protection.

For instance, I have given to one a brace of pistols, to another a Sabre, and you are perfectly acquainted with the necessity of satisfying the Chobdars and other servants of these petty princes, in order to procure supplies, guides, etc. The party that went to Jesselmair consist of a Hindoo writer, ... and 2 Hircarrahs, and besides handsome pay are to have a reward in addition. ... Besides the Lascars for the Perambulator and Hircarrahs with me here, I left people with a second Perambulator in camp.

[1] money-lenders. [2] DDn. 82 (49) 17-1-09. [3] Is that really so ? DDn. 81 (65) 8-2-09. [4] ib. (95) 13-5-09. [5] ib. (102), 15-5-09. [6] DDn. 82 (137) 27-5-09. [7] Jodhpur State.

All the additional sums would amount to 1,500 Rs. or thereabout; besides the instruments I have, I expect from England soon some that I commissioned to the amount of £ 100; were I to make a charge of these, Government might consider them their own property [221–4][1].

Garstin writes to White and Webb, both of whom had complained of delays and cuts in their bills;

I am concerned that so many obstructions should be thrown in your way by the Military Auditor General. His anxiety to recommend Himself to the Court of Directors gives much trouble to every one in the Service, but no one is permitted to interfere with him in the business of His Office, and this Gentleman and I differ so much in opinions on Public grounds that I have no influence with Him[2].

I have sent certificates to the Military Auditor General of having received your Field Books, ... and I shewed your letters to the Adjutant General and afterwards wrote to him, expressing my opinion that His Excellency the Commander-in-Chief might direct that you should be allowed the full allowances. This is the only means I have to prevent the Bills from being retrenched, and nothing in my power to obtain for you the very utmost allowances the service will admit of has been neglected.

There is no officer placed under me, who does his duty properly, that I do not endeavour to the utmost to serve, and render as comfortable as possible, but the economical regulations often frustate my best endeavours, and occasion frequent troublesome references, in which my representations are not always effectual.

I recommend you to send your bill for surveyor's allowances whilst employed in surveying cantonments, and your procuring the Commander-in-Chief's signature, for if it was an Engineer Officer that was thus employed the Military Auditor General could only allow him one hundred Rupees per month, but you are not an Engineer. If he strikes at you, I will mention the subject to Mr. Colebrooke[3]; more is not in my power[4].

To Morrieson in Bundelkhand [49–50] he writes;

All that is in my power to get you the whole of your allowances shall be done, and I hope to be successful, thinking you entitled to them to the day the detachment was dissolved, when of course they ceased. Officers employed with any army are considered to have time enough to protract their surveys and make fair copies on the days they halt, and particularly if, as your Detachment did, they make long halts[5].

On the whole it does not appear that the average surveyor made very much profit out of his allowances for, besides the pay of establishment and transport, and the purchase of instruments, he had often to bear misfortune by the loss of equipment. White, for instance, reports in 1809;

I hope...I shall be enabled to recover my full allowances for July. By the orders of His Excellency the Commander-in-Chief I was employed during the whole of that month in Survey, and owing to the extraordinary inclemency of the Season suffered very severely in my Health. Since my return to Delhi I have lost four Camels, which I entirely attribute to the fatigue they underwent in the marches of July, August, and September[6].

He applied unsuccessfully for the allowances of a river surveyor during his survey of the Upper *Doāb*, on the grounds that he had to hire boats for survey of the Jumna, and Crawford writes;

I will recommend your being allowed river surveyor's allowances, ... but...Government are exceedingly averse to granting them unless it appears indispensably necessary and greatly calculated to promote the public service. Do recollect that the Surveyor General receives only 500 Rupees per month, and no sort of emolument whatsoever [324] and they are herefore ever reluctant in increasing those of surveyors under any pretence whatsoever[7].

For the closer control of expenditure the Surveyor General was directed to report annually on the 15th June the number of officers employed in surveying, the nature of respective surveys, and whether finished or otherwise[8].

MYSORE SURVEY

Salaries for officers on the Mysore Survey were fixed by Governor General before he left Madras in 1799;

[1] DDn. 82 (212) 7–8–09. [2] To White; DDn. 126 (2) 29–3–10. [3] Henry Colebrooke, Member of Council. [4] To Webb; DDn. 81 (200) 25–1–10. [5] DDn. 126 (56) 15–7–10. [6] DDn. 82 (16) 24–10–09. [7] DDn. 126 (152) 2–6–12. [8] CD to B. 12–3–13; DDn. 129 (51).

The Governor General in Council, having deemed the salary heretofore granted to you as surveyor to the Nizam's Detachments [I, 281, II, 132] to be inadequate to the extent and importance of the survey now ordered, or to the expense which you are likely to incur in your travels, has in lieu thereof granted you a salary of four hundred pagodas per month[1], including incidental charges, but exclusive of the establishment of public servants allowed for this service.

His Lordship has permitted Dr. Heyne to draw a salary of seventy five pagodas per month, in addition to his pay and allowances as an assistant surgeon, and Mr. Mather will continue to receive his present salary of fifty pagodas per month.

The liberal footing on which your appointment has now been placed will enable you to afford such assistance to Dr. Heyne and Mr. Mather as will render the above salaries more than sufficient for their extraordinary expenses[2].

Warren's allowances were to be substantially those fixed in 1777 [I, 279], being additional to his basic pay as subaltern.

Captain's Subsistence	*Pags.*	37–21–0[3]
Captain's ½-Batta (the other half being already drawn in cantonments)		37–21–0
Horse allowance		6–00–0
Tent		5–00–0
Puckallies		7–00–0
Interpreter		10–00–0
Lascars' Pay & Batta		23–02–0
	Pagodas	126–02–0[4]

Arthur drew similar allowances, except that being an Engineer he only drew the *batta* of actual rank, whereas other officers were allowed *batta* of the next higher rank. Tents and their transport or an allowance in lieu were provided by Government.

The Directors considered these allowances far too generous;

Whilst we admit the utility of the proposed survey of the Mysore Territories, we are of opinion that the same might be conducted upon a scale of greater economy. The salaries and establishments...cannot be estimated at less than between 15 and 16,000...Pagodas per annum.

We therefore direct that the salary to Captain McKenzie...be reduced to Pagodas 200...per month, being the salary allowed him for similar services in the Dominions of the Nizam. The salaries and establishments of the other Gentlemen employed in this service must likewise be regulated upon a scale of greater economy. Our orders cannot be considered as a hardship, since the officers...are in the receipt of the pay and allowances annexed to their respective ranks and stations[5].

The allowances, covering both salary and establishment, were accordingly reduced from 1st December 1801 to

Captain Mackenzie, *Pags.* 420—Mr. Mather, 116—Lieutenant Warren, 100—Ensign Arthur, 100—Dr. Heyne 100[6].

This created profound disappointment, and Mackenzie expresses his disgust, to Lambton;

You enquire of future plans; whatever these might have been is nearly overturned by the late order of Government reducing the several surveyors so very considerably. ... My own salary is reduced more than half nominally, but in fact still more, as I disburse considerably for contingents, according to stipulation in giving me a salary. Upon the whole I look upon it that they wish to discontinue the survey.

I am concerned to observe yours also subjected to this diminution, but how much I do not know, as I have no idea of the amount of your establishment[7].

Mather's original allowances had been 148 *ps.* 24 *f.* 72 *c.*, including apprentices, lascars, and followers. Instruments were free of charge, but he had no separate regimental pay like the military officers, and Mackenzie writes sympathetically;

I do not at all despair of getting your case considered in proper point of view. ... The late severe orders are entirely from home, from the Court of Directors, who I am convinced will see their error on having the results before them. ... The gentlemen at Madras are not hostile to the survey. ...

I cannot believe but these allowances must be...exclusive of the establishment, as it

[1] 80 *kas* = 1 *fanam*; 42 *fanam* = 1 *pagoda* = about 3½ rupees or 8 shillings. [2] DDn. 68 (3) 4–9–1799. [3] the regulation ten shillings a day. [4] MMC. 4–2–1800. [5] CD to M. 10–6–01 (18). [6] From M. Pol Dept.; DDn. 68 (42) 10–11–01; BPC. 26–7–04 (5). [7] DDn. 66, 30–11–01.

would be absurd to suppose, when they [the apprentices] are meant for accelerating the work and rearing them up, that they should be defrayed by the surveyor[1].

It was eventually ruled that Mather should draw the full allowances of a surveyor from the date of his appointment[2].

Mackenzie writes to Warren, who already had thoughts of transfer to Lambton's survey ;

I have addressed a letter to get to know whether the Lascars may be returned or discharged, or the boys returned if they come within the diminuation. I can hardly think they do, yet... when such unfavourable orders have come from home there is no depending on former maxims. I find many others suffer, or are likely to suffer as we. *If you can get anything better, I think you are certainly right to strive to mend your situation.* The pittance left is by no means adequate to the toil of the survey[3].

He was himself granted some relief by the Madras Council;

From the period when the reduction in your salary as Superintendent...was carried into effect, the incidental charges incurred by you on honour on account of the Survey shall be reimbursed to you, together which the additional expenses to which you have been subjected for the employment of extra Writers and draftsmen[4].

It is obvious that, in making these cuts, the Directors had no conception of the costs of instruments, camp equipment, assistants, followers, and transport, that a surveyor had to provide out of his salary.

MILITARY INSTITUTION

Troyer's salary as instructor to the Institution was 250 *ps.* a month, and that of his assistant 50 *ps.*

During their first field surveys round Madras the students were allowed "to draw full Batta[5] for the period during which they were so employed", but for their second season which took them further afield, they drew survey allowance on the Governor's recommendation

that some remuneration should be granted to them while engaged on a duty of great fatigue and of no inconsiderable importance. ...

They have been educated in some measure at the expense of the Company, by whom their instruments and other materials for drawing have been uniformly provided. ... I would therefore propose to limit their additional allowances in the first instance to the Full Batta of their own Rank, and to the Staff Pay and Horse allowance of regular surveyors. ...

The Field allowances of their Rank, with the addition of Horse allowance, are sufficient only to defray their expenses while on Survey ; the Staff Pay therefore of Ten shillings per diem[6] may be considered as the amount of their remuneration [I, 275, 279]. ...

I do not consider the salary of the Mathematical Instructor to be more than a sufficient compensation for the very zealous and successful discharge of his ordinary duties. As that Officer therefore will be laboriously and actively employed in Superintending the proposed Survey, I conceive it to be just that he should receive in the first instance the full allowance of a Surveyor as established by the Regulations[7].

Troyer and his assistant instructors continued to draw regular allowances when in the field, even though the Directors protested that his "labours while employed in superintending the survey could not add considerably to those of his Original duties"[8].

The officers who, from 1807, were posted to survey under Lambton and the Quartermaster General continued to draw these allowances, but after the reorganization of 1810, students were limited to the salary of third class surveyors of the Q.M.G.'s department, viz., 25 ps. a month, besides *batta*[9] [321].

MADRAS SURVEYORS, 1807–15

In 1807, when Arthur was appointed "Surveying Engineer with detachment

[1] DDn. 66, 18–12–01. [2] Govt. to Mackenzie, 15–12–02 ; BPC. 26–7–04 (7). [3] DDn. 66, 29–2–01. [4] DDn. 68 (6) 19–11–03 & BPC. 26–7–04 (10). [5] Full *batta*, Ensigns & Cornets, *ps.* 28–10–58 ; Lieuts., 37–30–24 [6] *ps.* 37–21–0 [330]. [7] MMC. 11–11–06. [8] CD to M. 3–8–09 (136). [9] SG.'s report, 1–5–13.

surveying in Travancore", his pay and allowances totalled *pags.* 169–05–32[1] ;

As Lieutenant of Engineers ;			
Pay as Lieutenant for 30 days	*pags.*	18–31–40	
Half Batta as Lieutenant		18–31–40	
Gratuity as Lieutenant		7–10–40	
Tent allowance		12–00–00	56–31–40
As Surveyor ;			
Captain's Pay for 30 days	*pags.*	37–21–00	
Difference between the half and full Batta of his rank (Lieutenant)		18–31–40	
Allowance for a Draftsman		15–00–00	
,, ,, an Interpreter		8–00–00	
,, ,, a Horse		6–00–00	
Additional Tent allowance		6–21–00	
Pay and Batta to a Puckally		4–26–32	
A Guide		6–00–00	
Allowance for a Boat		9–00–00	112–15–72

The Quartermaster General considered this insufficient ;

The importance and the difficulty of the survey of Travancore appear to suggest the expediency of placing it in an equal footing in regard to establishment and allowances with the other subordinate surveys, but in both those respects the survey of Travancore has been regulated on a much more reduced scale than the survey attached to the Hyderabad Subsidiary Force, ... although the Nizam's Dominions present much fewer impediments to the operations of a survey than Travancore.

Allowances were accordingly raised to equal those "of the Surveying Engineer at Hyderabad, with the addition of the small establishment of boats already sanctioned"[2], but in 1810 General Hewett's report shows that Arthur's survey allowances with "office establishment" amounted to 150 *ps.* a month, whilst Blair in Hyderābād drew 100 only[3].

In 1809, when Garling took his party on independent survey [127] he was granted 25 *ps.* a month in addition to 50 as assistant instructor and field allowances[4]. After his move to Goa, and the re-organization of 1810, the 25 *ps.* allowance was dropped, and in 1812 he had to surrender the assistant instructor's allowance to Walpole [319], being compensated by a special salary of 70 *ps.* ;

The personal allowances which have hitherto been drawn by Lieutenant Garling on account of the Goa Survey were in all respects the same as were drawn by the other Officers attached to the same survey, ... and I consider that he was amply remunerated. ...

The resolution in favour of Lieutenant Walpole will accordingly reduce the personal allowances of Lieutenant Garling from Pagodas 114–2–20 to Pagodas 64–2–20. The latter sum is not in my opinion sufficient for the remuneration...as Superintendent of the Goa Survey. His Assistants receive each an allowance of 60 Pagodas, and the full batta of their rank. From these allowances the Assistants have only to provide their lascars, and the Superintendent of the Survey (by the reduction of his salary of 50 Pagodas...) would be placed on an allowance somewhat inferior. ...

I would therefore propose that Lieutenant Garling should be permitted to draw salary of 70 Pagodas per mensem and the full Batta of his rank, as allowed to the Officers lately attached to Major Lambton, and as laid down in the 15th paragraph of the General Orders of the 9th October 1810 for the first class of Officers...attached to the Quarter Master General's Department [323], and that his Establishment should continued to be kept up at the public expense. This arrangement will give him a net allowance of Pagodas 89–15–60, causing a reduction from his present allowances of Pagodas 24–31–40 per mensem, but leaving an allowance which I consider sufficient[5].

Garling's pay was increased the following year to 150 *ps.* a month, to cover all expenses except lascars[6]. The pay of other officers employed under the Surveyor General was fixed at

full Batta and the salary of 60 Pagodas, ... inclusive of all allowances of whatever description ; out of this it is expected that they will defray the charges of the Establishment of Lascars,

[1]MMC. 28–7–07. [2]ib. 6–11–07. [3]DDn. 84 (93) 27–8–10 (251). [4]MMC. 2–1–09. [5]From SG. ; ib. 17–1–12. [6]ib. 5–2–13.

Packallies, &c., attached to them, which are no longer to be continued at the expense of the Company[1].

Officers of the Quartermaster General's department were graded in three classes, the first to draw 70 *ps.*, the second 35, and the third 25 *ps.*, a month besides full *batta* [321][2].

Survey allowances were not drawn until the date of taking over duty, and were suspended during absence on leave[3].

LAMBTON'S SURVEY

On Lambton's first appointment in February 1800, he was granted, extra to regimental allowances, a salary of 200 *ps.* a month and pay of establishment at something over 100 *ps.*[4]. Under orders sent out by the Directors in 1801 [330] this was reduced to 280 *ps.*, all inclusive[5].

In May 1811 this was substantially raised ;

A mónthly salary of pags. 400 will be allowed to you from this date, exclusive of your establishment, and...when H.M.'s 33rd Regiment shall depart for Europe, you will be permitted to draw an extra salary equal to the Company's allowances of your Regimental rank [304–5].

This extra salary will of course be made to correspond with the Company's allowance to a Lieutenant Colonel when you shall have attained that rank regimentally, and in both cases it will be regulated according to the Company's allowance of a Major, or a Lieutenant Colonel on the peace establishment[6].

Warren's allowances on the Mysore Survey had been reduced to 100 *ps.* a month but were raised by 35 *ps.* from 1st Octover 1802, the date he joined Lambton, on his appeal "for the expense of a Palanqueen and the hire of additional coolies" ;

In carrying on the present rapid work, where every stride is generally a long day's march, ... although my allowances be the same, my situation in point of carriage and other charges is more expensive than it was when employed in Mysore, where, instead of crossing several provinces in the course of a few months, I have at times been detained a whole year within the limits of a District. ...

Moreover, in carrying on...the present survey uninterruptedly through the different climates of the year, the use of a Palanqueen may be considered not merely as a matter of conveniency, but of real necessity, as affording when indisposed the means of resorting to places where medical assistance can be obtained. This expence...my present allowances of 100 Pagodas per month do not admit of, and so precarious has the state of my health been since my survey of the eastern Polliams in Mysore, that I have to request...an additional sum of 35 pagodas per month, ... to provide for the above expences[7].

Kater was allowed this same allowance from February 1805[8].

Lambton's officers from the Military Institution drew the allowances laid down in 1806 [331], but from March 1811 they were allowed 70 ps. a month in addition to *batta*, "as they will now be employed on a scale for superior to that of any other description of survey"[9].

LAMBTON'S ESTABLISHMENT & EXPENDITURE

The establishment allowed to Lambton on first appointment [234] comprised[10]

1 Writer, per month, Pag. 15—1 Draftsman, 20—Horse allowance, 6.

Tents

1 Marquee
2 Private
1 Necessary
1 Observatory

} lascars, bamboo coolies, and carriage bullocks, & the usual complement.

[1] MGO. 9–10–10 (12); ruling by MAG. July 1811, DDn. 127 (49). [2] MGO. 9–10–10 (15). [3] ib. 5–10–08 ; MMC. 16–8–11. [4] ib. 4–2–1800. [5] DDn. 41, 10–11–01. [6] DDn. 62 (112) 21–5–11. [7] ib. (43) 22–7–03. [8] DDn. 63 (117) 21–2–05. [9] DDn. 62 (98) 3–12–10 & MMC. 8–3–11. [10] DDn. 62 (1) 6–2–1800 ; MMC. 4–2–00.

Packalies [water carriers]	Pag.	7	1 Carpenter, and batta ...	Pag.	4	Fms.	12
Interpreter ...	,,	10	1 Smith ...	,,	4	,,	12
8 Lascars ...	,,	20 Fms. 02	2 Hircarrahs ...	,,	5	,,	06

Before leaving Madras he pointed out that

my net allowance has not been mentioned. ... At present I am provided with one large tent, one observatory, two baggage tents, and a necessary. I shall also have to provide a tent for the two boys who are to attend me, De Penning and Lawrence [346], and there is another observatory tent come with the large instrument from Bengal, constructed purposely for it [252]. ... The expences for tent carriage, tent lascars, and Bamboo Coolies, must be very great. At present it amounts to sixty-two pagodas per month, and I do not know how I can reduce it. ...

I am allowed eight lascars for...carrying instruments, etc. That number was sufficient to carry what I had, but the instruments that have come from Bengal take up five large cases, which are at least two Bandy[1] loads, and yet they are so valuable that I cannot leave any part behind[2].

Government was unusually liberal :

His Lordship relies on your discretion for conducting the survey entrusted to you with every proper degree of economy and...the Civil Auditor will be instructed to pass your charges for the above purpose on the certificate of your honour that they were actually and necessarily incurred. ...

For the expenses of the two boys employed, you will receive an allowance of ten Pags. each per month for the present[3].

After his return from Mysore, Lambton asked for an increase of transport ;

In England, where precisely the same kind of instruments are used, they are carried in carriages constructed for the purpose, and furnished at the expence of the Board of Ordnance, but in this country every thing of that nature must be carried by Coolie on account of the badness of the roads. Such Instruments require great care, and if once injured they are not to be repaired here. The people who carry these articles must be always attached and present, so as to move every thing at once in any direction.

During my time in the Mysoor, I made various changes in my establishment, until I got into a system the most perfect I could fall upon for expedition, and, notwithstanding the great number of people I had with me, I do not recollect that my monthly expences ever amounted to Four hundred and thirty Pagodas, except some casual expence happened to increase them, which rarely happened[4].

Such casual contingent expenses were

incurred in preparing the apparatus for the measurement of a Base line, which consists of Coffers, elevating screws, pickets, and various other articles. ... There have been, and will occasionally be, other small contingent expences peculiar to this kind of work, such as building and keeping in repair an observatory tent, bell tent, and signal flags ; blue lights, etc.

A permanent establishment of 43 coolies was then authorised for transport of instruments and special tents at a monthly charge of two *pagodas* a head[5]. To guard his instruments he was allowed to entertain his own escort whose

expences shall be brought on in a monthly contingent account [359]. ... Also a peon for...keeping up a communication with the post Road, as I shall rarely be within ten or fifteen miles of the track of the Tappal, by which means all regular correspondence will be interrupted[6].

He further obtained special authority for his bills to be met by any convenient Collector or Military Paymaster[7].

It was only natural that during the strict scrutiny of expenditure made after the close of the Marātha war Lambton's survey should come under notice, but all the same he was much disturbed by a query from "the Committee of Finance" as to whether it was not "practicable to reduce a part of that expence"[8]. He replied that,

as every augmentation to my establishment have been regularly authorised by Government in consequence of public communication from me, ... and as the objects of those communications were deliberately considered, ... no diminuation can be made without lessening the means of efficiency, and consequently checking the progress of the survey[9].

[1] Bullock cart. [2] DDn. 62 (4), 16–8–00. [3] ib. (5). [4] DDn. 63 (68) 17–3–02. [5] MPC. 8–4–02 ; DDn. 62 (20). [6] MPC. 9–7–02. [7] ib. 1–10–02. [8] Letter of 24–7–06 ; ib. 3–2–07. [9] 13–10–06 ; ib. 3–2–07.

We have not found his less dignified protests which Warren describes as drawing a rebuke from the Governor [264-5].

The Supreme Government took up the attack the following year, pointing out that "a rapid augmentation appears to have taken place" in the survey world ; Mackenzie's survey had cost 12,237 *ps.* in the year, and Lambton's 7,132, whereas several useful surveys had been suspended in Bengal for lack of funds [12, 60, 112].

Lambton once again went over all his expenditure to show that every economy was exercised, and that,

> if the extent of my labours keep pace with the ability granted me to perform them, ... every addition to my establishment will prove economy in the end, and that to reduce any part of it will only serve as a check to my exertions, and impede the general progress of the survey[1].

He was strongly supported by Bentinck, who replied to Bengal ;

> This may be justly called a great national undertaking, extremely useful as the foundation of future geographical maps of which none exist ; and, as I am informed by those competent of judging in point of science, deserving of being classed amongst the best surveys of England and France. The opportunity of meeting with an Officer in India possessed of the same acquirements and equally qualified for so important a work may never again occur. I cannot therefore but recommend in the strongest manner that this survey may continue[2] [265].

The survey was not only allowed to proceed, but from 1807 to 1812 its scope was actually widened, and expenditure considerably increased by the appointment of officers from the Military Institution [242]. After the withdrawal of these officers, and the limitation of the survey to main triangulation only, the monthly bills dropped to under one thousand *pagodas* ;

Allowance to Major William Lambton	400–00–00	
Addition, equal to the Company's allowance to a Major for half-batta & Tent allowance	100–13–10	
Allowance for carriage of Instruments	66–00–00	
Pay of one Havildar, 3 Naigs, and 24 Sepoys, with Batta ...	77–07–40	
Pay of 24 flag Coolies and 1 Tappal Peon	50–00–00	713–20–50
Allowance to 4 Sub-Assistants	130–00–00	
Horse Allowance for ,, ...	18–00–00	
Tent Allowance for ,, ...	28–00–00	
Ten Lascars for ,, ...	27–00–00	203–15–00
Contingent account for November 1813 ; Base line apparatus ...	44–00–00	
For preparing the different Instrument Boxes of the Large Theodolite, the Circular Instrument, the Astronomical Telescope, and the Transit for the Base lines	10–00–00	
Aid given by the Inhabitants at the stations of ——, ——, —— (3 stations)	5–15–00	
Mr. J. De Penning's contingent account for October 1813 ; Aid given by the inhabitants at the several stations of ——, ——, (8 stations)	7–03–00	66–18–00
Total Abstract ...		983–08–50
Deduct abstract of stoppages sent to the Secretary to the Native Fund committee [357]		2–40–00
Net Amount to be paid *Star Pagodas* ...		980–13–50[3]

SURVEY EXPENDITURE, MADRAS, 1810–5

Unlike the Surveyor Generals of Bengal and Bombay, the Surveyor General of Madras had to keep an account of expenditure on all surveys, whether under the control of the Quartermaster General, Lambton, or himself[4].

[1] MPC. 14–7–07. [2] ib. 7–10–07. [3] DDn. 63 (333), 1–2–14. [4] MGO. 10–9–10.

At the end of April 1811, before sailing for Java, Mackenzie submitted a statement of the actual expence incurred for the different surveying establishments under this Presidency on the 1st of December last, compiled from the several accounts communicated to me from the offices of Audit, Civil and Military. ... This statement affords sufficiently authentic Data of the real expence attending the former establishment, with the exception of the different stores, Instruments, and stationery supplied from Europe. ...

The amount of the last Quarter is pagodas 8,840–44–45, but as the expence of the Travancore and Jalnah surveys have entirely ceased since that period, the expence of the succeeding quarter will be so much less.

The establishment for the office of the Surveyor General has also been suspended, ... and... by G.O. of the 9th October an establishment of 150 pagodas per month for draftsmen and Writers was allowed. ... It has now been ascertained by 3 months experience what persons are necessary, ... making at the utmost pagodas 645–41–40 per month, instead of 600. I have not included Ensign Ward, the Assistant in the office acting during my absence on the expedition...as this also was not foreseen till very lately, and may be considered as a temporary expence. ...

The rest of the establishment will be continued...on the Materials of the Geographical and Statistical survey of the Ceded Districts, which on the 1st December last amounted to pagodas 391–12–40 per month, but...is near approaching to its conclusion[1].

The Surveyor General submitted regular quarterly statements of establishment and expenditure, explaining such details as extra allowances for officers and draughtsmen with the Quartermaster General, and for surveyors working for the Inspector of Tank Repairs. From August 1811, however, surveyors with the tank department and with the Collector of Madras were omitted, as not being available geographical work ;

The current monthly expense...has now been reduced to Pagodas 3,76–833–25 per mensem, or Pagodas 45,224–39–60 annually and ,if to the latter sum be added...the expense incurred on account of the Military Institution when the students are sent out to survey, the current annual expense will still amount to Pagodas 50,116–17–05[2].

The distinction between military and civil expenses was not always clear ;

While the salary of the Surveyor General and the establishment of his Office are properly included under the Head of General [civil] Disbursements, the salary and allowance of his Assistant are stated as Military. ... The Principal and his Deputy are both Military men, and their duties must be exactly similar. ...

Again, the expenses...in the Ceded Districts...are rightly stated as General Disbursements, while those of the Trigonometrical Survey under the superintendence of Major Lambton are considered to be partly Civil and partly Military. ... The survey in question, being a work of science and of general utility, is more than a national concern, and must therefore be independent of all Military considerations[3].

On his return to Madras in 1815, Mackenzie undertook an exhaustive review of the department, and with his final report submitted a concise view of the Expense, accompanied by a Table showing the Annual and Quarterly sums applicable to each branch of this Presidency for these last five years, from the Establishment of the Surveyor General's Department on the 1st December 1810 to the 1st December 1815. ...

The magnitude of the sum expended will naturally attract the first notice, since it exceeds so considerably the sum of £ 20,000 p. annum considered in the Honorable Court of Directors' Letter of the 3rd June 1814 as a subject of immediate reform. The abolition of the Office of the Surveyor General at the Presidency was one of the first steps ordered towards bringing this expenditure within a moderate Compass, while from the accompanying Table it appears that the System on which that office was introduced...was attended by a very considerable reduction of expense, & more effect in the execution of the Surveys than had ever before been obtained. In vindication therefore of the economy of the measure...it becomes necessary to examine more minutely into the Heads of this expenditure. ...

General Department—comprehending what is properly civil, including commercial, Financial, & Political, & Nautical Heads. ...

Military Department—comprehending Roads, Military Survey, & Military objects.

Such agricultural Surveys as have been executed under the Revenue Board, and Professional Surveys under the Engineer Department & Tank Department have not been included. ...

[1] MMC. 26–4–11. [2] ib. 10–12–12. [3] ib. 10–12–11.

The Account for the year 1810 would amount to upwards of £ 34,000 [85,000 *ps.*] for supporting the different establishments. ... In the first year, ending the 31st October 1811, the aggregate expense was reduced from Pags. 85,514–3–60 per annum to 52,439–42–27;—General 32,540–14–30—Military 19,899–27–00.

This reduction was effected...in the Civil Branch...by the transfer of nine Native Surveyors [348] to other Departments ; by the abolition of the Surveying School, and of the Inspector of Revenue Surveys & Superintendent of that Establishment—In the Military Department—by the recall of 5 Officers out of eight on the Survey of the Territory of Goa ; of 4 Officers from the Trigonometrical Survey ; & 12 Officers from the QrMrGenl's. Department & from Surveys in the Nizam's Country & Travancore, ... and of 2 Officers of Engineers withdrawn from the Superintendence of Surveys. ...

In this year 1811 the Survey of the Ceded Districts & of the Goa Territory, of the Southern Provinces, of Tinnivelly, Tanjore, etc., were transferred to, & carried on under the Surveyor General's direction. Tanjore was entirely completed.

In the 2nd year, ending 31st October 1812, a further Decrease took place & the aggregate amount was reduced to Pagodas 46,554–44–00 ;—General Establishment Pags. 29,913–39–30—Military Establishment 16,641–5–25. ...

In the 3rd year ending 31st October 1813, the sum total was increased...Total in 1813, Pags. 50,511–17–52—General...Pags. 34,567–27–75—Military...15,943–34–57.

In the 4th year, ending 31st October 1814 ; Total...53, 655–8–10...—General...Pags. 36, 242–28–40—Military... 17, 412–24–00—.

In the 5th year ending 31st October 1815, a more considerable diminution takes place, ... chiefly from the abolition of the Surveyor General from the 1st May 1815. ... The Soonda Survey was completed & that of Koorg begun, but difficulties in finishing Dindugul prevent the commencement of the Survey of Travancore. —General Department...Pags. 34,465–27–75—Military...14,132–6–12. The expenses of the Ceded District Survey entirely ceased in the month of July 1816.

The aggregate expense of all the Surveying and Mathematical Branches of Expenditure... amounted on the 1st December 1810 to about Pags. 85,514 per annum, ... The aggregate expense had increased rapidly from the year ending 30th April 1803, from about 23,150 per annum, and perhaps in 1793 from about only 7,000.

The Trigonometrical Survey had incurred an expense in 5 years of 55,502 ; or per annum, 11,100 [*ps*].

Of the duties of this office, its utility to the Service, evinced in the saving of a sum of no less than 165,000 Pagodas in the course of 5 years, exclusive of the fact of bringing for the first time into one collected view the results of all the Surveys, ... I wish to refer rather to a future occasion[1].

BOMBAY SURVEYORS

The standard daily allowance for casual surveys in Bombay was the regulation staff pay of ten shillings, or four rupees, that was authorised in Madras as early as 1767 [I, 279]. Officers detached on regular surveys were allowed monthly "500 rupees in lieu of everything", and this was the rate drawn by both Emmitt and Moncrieff, assistants to the Surveyor General.

Drummond was appointed in June 1810 on Rs. 120 a month, and on Moncreiff succeeding as first assistant, was recommended for promotion to two hundred rupees per month ;

Should this meet your approbation, Mr. Drummond's situation as my second Assistant becomes vacant, to fill which I beg leave to recommend Lieutenant Sutherland, a nephew of the Commodore's[2], on the same salary of one hundred and twenty rupees[3].

When Williams offered his services in 1803 he made it a condition that he should to continue to draw the Madras allowances which he drew with the Pioneer Corps in Malabar, Rupees 638–7[4] ;

	Star Pags. F. C.	Rs. As.
Pay and Allowances as Surveyor ...	85 – 33 – 40	300 – 1
Tent Allowance	12 – 00 – 00	42 – 0

[1] *General Report on the State of the Surveying Department at Fort St. George* MRIO. M. 561, 30–4–16. [2] James Sutherland ; Bo Marine ; Commodore, Bombay 1798–1801 ; Master Attendant, 1802–5. [3] Bo MC. 10–2–02. [4] Bo MC. March 1803.

		Star Pags. F. C.		Rs. As.
Extra Half-Batta, for 31 days	...	19 – 15 – 60	...	67 – 3
Pioneer Allowance „	...	19 – 15 – 60	...	67 – 3
Pay & Allowances of rank ...	...	45 – 36 – 60	...	160 – 2

On Drummond's resignation [305, 323] Government offered Nutt only two rupees a day as draughtsman, but consented to the normal four rupees on Williams' protest :

The nature of the duties that we have to discharge in this office require a degree of steady attention and assiduity, which in few other situations are known or necessary. Without forming & adhering strictly to a system of unvaried industry for myself and all those employed under me, I am certain that many of the great objects in the view of Col. Reynolds...would be lamentably delayed, or never at all attained. These were my ideas when I took upon myself to propose an allowance of 120 rupees per mensem for Mr. Nutt. ...

I shall use my endeavours to get a young man to undertake the duty on the terms which the Hon'ble the Governor is pleased to grant, but he will most probably be wholly inexperienced, and it takes a considerable length of practice to acquire the adroitness in this work, which is when acquired so useful[1].

In accepting the rates of pay proposed for the survey of Gujarāt at the end of 1808 [170–1], the Military Accountant General remarked ;

The Surveyor General...proposes that Captain Sutherland should be continued on his present salary, and that the other assistants should have each Rupees 250 in addition to the field allowance of their respective ranks.

As I was not sufficiently acquainted with either the duties on which these gentlemen would be employed, or the expense to which they would be exposed, to offer an opinion, ... I had a conversation with Captain Williams on the subject, and, ... I really think that, considering the nature of the service, and the probability of its only being temporary, the allowances he proposes...are moderate.

To each of the Assistant surveyors...a previously arranged plan is to be entrusted and, as they will be dispersed over an extensive tract of country, they will be obliged to keep up distinct establishments for their own accommodation. ...

Captain Sutherland draws at present Rupees 500 a month as surveyor, exclusive of his fixed salary of Rupees 200 as Assistant to Captain Williams ; I should think, however, that Rupees 500 a month would be an adequate remuneration on the present occasion[2].

Garstin's comments were that,

if the officers selected for this duty are, as they certainly ought to be, able, industrious, and intelligent men, the allowance granted to them...is certainly moderate ; for most undoubtedly they must either be at a very considerable extra expense for the transportation of their baggage, camp equipage, instruments, etc., as well as to procure the decent comforts of life at such a distance from Home, or be compelled to suffer great privations ; which, together with the hard labour a surveyor is unavoidably forced to undergo, must be attended with great risk of health and injury to their constitutions. ... An addition to the common allowances will operate as an encouragement to men of science to stand forward, and the importance of having able men employed on this line of the service is very obvious[3].

Dickinson's salary as Revenue Surveyor was Rs. 400 a month in addition to Rs. 295 for establishment. William's salary as Revenue Surveyor at Broach was Rs. 500 [326], whilst Sutherland still drew Rs. 200 "as first Assistant to the Surveyor General" besides an extra allowance of Rs. 100. On both survey sthe senior assistants drew Rs. 250 and the remainder 120 each[4]. Dickinson had been allowed the temporary assistance of Macleod on two rupees a day as draughtsman, but this was advanced to regular assistant on Rs. 120 a month in order to expedite the outdoor work[5] ;

On his first appointment to the office he was merely directed to assist in finishing certain plans. ... This change of situation immediately brought on him the expense of keeping a palankin, etc., as his constant attendance was required badly in the office for the first fortnight. ...

About that time I received from the Governor a verbal order for the survey of Colaba, and was...desired by him to employ Ensign Macleod on this duty. ... He was, in concert with

[1] ib. 29–4–07. [2] from MAG. Bombay ; 27–12–08 ; DDn. 82 (98). [3] DDn. 81 (78) 13–3–09 & B Pol C. 20–3–09 (18). [4] Bo RC. 2–2–14. [5] from 1–12–13.

Lieutenant Gordon and myself, for some time employed each day in surveying between six and seven hours, and plotting the work of the former day in the office, and filling up any spare time there by assisting in drawing the plan of Bombay. Since the 24th July he has been occupied, with the exception of 3 or 4 days when the weather would not admit of our working out of doors, never less than 9 hours of the day. ...

The expence necessarily incurred by his attendance in this office...amounts to nearly 50 Rupees a month, to defray which, and remunerate him for his extraordinary labours in surveying, he receives only the allowance for drawing, ... vizt. 60 Rs. a month [176]. ... Such being the duties unavoidably attendant on whomsoever they think fit to add to this Department[1].

When Sutherland accompanied Harford Jones to Persia [176], he was allowed to retain his allowance as first assistant to the Surveyor General throughout his absence from India, even during his stay in England[2] ; but on the other hand Nutt's request to continue his allowance during ten months leave out of India on medical certificate was firmly refused, and "his observations on the occasion" declared "irregular and improper"[3].

There was much correspondence about the allowances to be drawn by Malcolm's surveyors in Persia [174–5], who carried out many hazardous journeys. Christie and Pottinger were allowed full surveyor's allowances @ Rs. 618 a month, in addition to their political allowances of Rs. 300, for their adventurous journey of seven months across Baluchistān [174]. Government overruled an audit objection which pointed out that the sum of Rs. 618 was originally intended to cover an establishment of assistants and followers [I, 276–7] which could not have been required under the circumstances.

With regard to Frederick, it was considered that he was more than a mere surveyor of routes, but not to such an extent as Pottinger and Christie. In his case therefore the allowance of Rs. 618 had to include the political allowance. The remaining officers were granted Rs. 100 each in addition to political allowance[4].

[1] ib. 9–2–14. [2] CD to Bo. 14–4–13 (27) & Bo to CD. 27–12–13. [3] Bo MC. 28–12–14. [4] Bo Pol C. 5–11–12 (44).

CHAPTER XXIV

CIVIL ASSISTANTS

Bengal — MADRAS: Surveying School — Mackenzie's Sub-Assistants — Lambton's Sub-Assistants — Assistant Revenue Surveyors — Pay & Allowances — Nominal Roll.

SO early as 1768 the Paymaster General had expressed disapproval of any person who was not "in the Company's Civil or Military service" being employed on survey [I, 268]. This prejudice persisted forty years and longer, and eventually led to a definite prohibition against the instruction of any "native" in the art of survey [I, 283 n.8], or the employment of any local man, however efficient, even as a draughtsman.

When Fleming asked for permission to employ a very useful half-Portuguese draughtsman, Francis De Cruz, the Surveyor General replied ;

When Lieut. Webb was sent to the Gungoutri, or source of the Ganges, he was accompanied ...by Mr. Hearsay a pensioner of the Mahratta Horse who, when the survey was over, surreptitiously obtained a copy of the survey, and had the impudence to send it to the Court of Directors, as if he had been the discoverer of this Holy Fountain's head [77]. On Lieut. Webb's laying the case before Government, they took the affair up very warmly, and have since expressed a great dislike to any half-caste, or indeed any one out of the service, being employed in any branch of the surveying line. ... With these examples before me...I could not possibly take upon me to recommend De Cruz[1].

Fleming made a private appeal ;

As I have no *official* information of the very reasonable objection that Government has to employ people out of the Service in the surveying line, I...have a hope, as it is only a survey of the city, and not a province or district, that I may be indulged. To you *privately* I say that I only employ him, De Cruz, in making my plans, as I am not a very good draftsman, and my eyes are so very much injured by this very duty (surveying), that I could not, ... without a great deal of time and trouble, give in such a plan as I could wish[2].

Crawford then asked Government to sanction the 5½ months allowances already earned by De Cruz, but commented privately to Fleming, "It strikes me that if they grant De Cruz an allowance, they will not give him Rs. 125, where an officer only costs them 100 ; but we will see". The application was refused on the grounds that previous sanction had not been obtained[3].

The pay of all such assistants was really provided for in the surveyors' allowances [I, 276], and we find that Webb kept a draughtsman of his own, whereas Hodgson was not so fortunate, and writes to the Surveyor General ;

I should be very glad if I could engage a good draftsman or copyist in my service, not being able myself to make my maps so ornamental as I could wish.. Will...your draftsman in the office...enquire if such a man (a native) could be hired and sent up to me, to be ready to assist me in the recess [218]. Could I meet with a man of that kind I would gladly retain him in my service on liberal terms[4].

Crawford could not help ;

Draughtsman are so difficult to be procured, and so exorbitant in their demands, that General Garstin sent round to Madras to procure, without success [273][5].

Most of the surveyors casually picked up for temporary work were sailors, as was probably Alexander Melville, employed under the Marine Board between 1814 and 1816 to survey lands in the neighbourhood of Diamond Harbour.

[1] DDn. 135 (8), 23–7–13. [2] ib. 130 (35), 27–7–13. [3] ib. 135 (14), 12–8–13 ; 129 (55), 4–9–13. [4] ib. 130 (61), 6–2–14. [5] ib. 135 (35), Feb. 1814.

The situation in Madras was entirely different, thanks to the foresight of Michael Topping, and by 1800 over a dozen boys had been trained at the observatory surveying school, and sent out on survey, whilst others were still under instruction. They were articled as apprentices and bound to the Company for five or seven years [I, 284].

Besides language and drawing masters, an assistant instructor, or usher, was appointed in 1801—John Robinson, of the first class—whose health was then "not adapted to undergo the fatigue of actual service"[1]. When he left in 1807 for the survey of Tinnevelly [141], his place was taken by William Scott [344].

When Goldingham went on furlough in 1805 [195], his place in charge of the school was taken by Warren, who submitted in 1807

four plans of certain lands near Madras surveyed by some of the apprentices now receiving their education in the School, and some sketches intended to form and steady their hands as draftsmen. In drawing the attention of Your Board on these juvenile productions, I am far from presenting them as perfect professional performances. They are the first regular attempt...made here to combine practice with Theory. ...

This survey has been made with my own Instruments, and the lascars who attended the Boys were my private servants. They were therefore of no additional expence to the Public[2].

In forwarding these to Government the Revenue Board wrote that they

considered the system of education pursued in the school to be susceptible of some improvement, ... so as to render it more adapted to qualifying the young men as practical *Revenue Surveyors*. ...

The practice of deputing young men, imperfectly educated and without experience, to be at once employed in a separate capacity under Collectors, had been the great error. ... To remedy this defect, it is proposed in future that after a short preparatory course of education at the school the students, or, as they are termed, apprentices, be stationed with Gentlemen employed in an active line of professional duty, to be by them completed in the practical part of their profession, and that then, and not before, they be deputed to act in a separate capacity under the Collectors[3].

This had indeed been Topping's original intention [I, 273] and now, under Warren's regime the majority of the apprentices were posted to the Department of Tank Repairs, or to survey under Mackenzie. The following extracts are taken from new regulations drafted by Warren [347];

The system of education introduced in the school under Mr. Topping [I, 145–6] (which is the same as that followed at Christ's College)[4] is to be continued with the few following alterations.

After the first twelve months every apprentice is to be taught the use of the Plane-Table [145, 150] and be made to practice in the vicinity of Madras twice a week. ...

After sixteen months the apprentice is to be taught the use and adjustment of a Circumferentor and Theodolite, the method of taking angles accurately, constructing a series of triangles, and running levels ; and, when conversant in this practice, he is to be placed two years under the Superintendent of Tanks and Watercourses, or some other surveyor.

Should the Sub-Assistant have served two years under the Superintendent of Tanks or a surveyor, and be returned to the school, he is then to be considered as qualified to be placed under a Collector ; but, should his services not be immediately required in that line, he is...to be taught the use and adjustment of a Sextant, both for the purpose of Astronomical observations, and of taking Terrestial angles ; he is also to attend the Observatory with a view to make himself acquainted with the most useful problems of practical astronomy.

Instead of the Tamul language, hitherto taught in the school [I, 285], the apprentices are to learn the Hindustani tongue.

Some encouragement being necessary to create emulation, ... a sum of not exceeding 25 Pagodas per annum will be at the disposal of the Superintendent of the School, to present those boys who have been noticed during the year for their good conduct and proficiency with useful books or professional instruments [347]. ...

[1] MRC. 31–7–01 ; Robinson had married in 1799, when aged only 18. [2] M. Rev Bd. 8–1–07. [3] MRC. 16–1–07. [4] This suggests that Topping himself may have been educated at Christ's Hospital, London [I, 389].

As the boys...are educated for the service of the Revenue Department, none are to be employed in the departments without particular orders from Government [184]. But as draftsmen and sub-assistant military surveyors are frequently wanted by officers on the general staff of the army, ... they are permitted to send boys to be educated at the Surveying School. ...

A boy receiving his education is to be termed an apprentice[1].

Another class of boys was sent into the field early in 1808 ;

When the Monsoon[2] is over, it is my intention to detach the Boys...to the adjacent tracts, and to carry the present survey to the whole extent of the Home Farm [I, 94, 142]. ...

Most of the Boys now in the School having gone through their regular study indoors, their time cannot be better employed than in actual surveying in the Field. I have therefore taken measures to send them for the ensuing two months to survey in the vicinity of St. Thomas's Mount. ... I have supplied them with my own tents, that no additional charge might occur to the public on that account.

The school draughtsman, John Pereira, was kept busy ;

His duties are not merely confined to the work your Board may occasionally command from him, but...he has also to attend to the direct calls of Government upon this Office, and occasionally from the Marine Board, which together with the education of the Boys...in this branch of their profession leaves him very seldom unoccupied[3].

In the urge for retrenchment that swept over the Presidency about this time [112, 195], the value of the school did not escape question, and the Revenue Board pointed out that

the annual expenditure has progressively, and of late considerably, increased. The fixed charges of the Superintendent of the School...have amounted to the sum of Pagodas 183 per month, viz., salary 50 Pagodas—allowance for the maintenance of the students 100 Pagodas—pay of Moonshee 8 Pagodas—and of Draughtsman 25 Pagodas. ...

But besides this sum...various contingent charges have frequently occurred for the equipment of boys proceeding on service, purchase of instruments, etc. ...

In the present circumstances of affairs when, from the necessity of reducing the public expenditure, many establishments of acknowledged utility have been suppressed [334–5], it is the duty of the Board...to suggest that the whole of the foregoing charges...might be immediately dispensed with by the abolition of the Offices in question[4].

The school survived this crisis, and there was constant demand for the apprentices who also turned out useful work in the course of training. Two boys[5] were attached to the Military Institution under the immediate supervision of Troyer, who reported that he

found them perfectly instructed in the method of taking observations with the Theodolite, as well as in the calculations required. ... They shewed...a sufficient foundation of Mathematical knowledge for...the various applications thereof relative to Civil and Military Surveys ; and as they are, besides, by no means deficient in skill and neatness as draftsmen, I cannot but declare that they have been useful to me, and will be useful to any Military Surveyor[6].

In 1809 Warren submitted

a plan of certain land between the North of the Mount and Poonamalee, the result of the short campaign lately made by the Boys now on the foundation. ... I also submit the section and plan of two series of levels, carried from a certain spot on the Banks of the Cooum River to the Bank of the Tank at Madrava. ...

The tract here represented is contiguous to that which was surveyed by the Boys last year, ... and may be extended at pleasure without any material expence to the public. ... As these plans...may prove of utility to the Collector of the Jaghire, ... they may be forwarded... to be deposited in his Cutcherry[7].

In 1810, it was decided to abolish the school [139, 347], and transfer to the Surveyor General such boys as were still on the establishment. Warren reported that

it has been resolved that these Boys be paid individually the amount of their subsistence, hitherto drawn by the Superintendent of the School. This allowance is 10 Pagodas per month for each Boy, which includes the school servants' wages (consisting of a Maty, a Cook, a Waterwoman, a Compadoor, and a Peon), their diet, clothing, the furnishing of Instruments and Books necessary for their instruction, and other contingent charges. ...

[1] DDn. 133 (302), 17–1–07. [2] N.E. monsoon, closing in December. [3] M. Rev Bd. 18–1–08. [4] From Rev Bd. 25–8–08 ; MRC. 5–10–10. [5] Marcellus Burke and Terry. [6] M. Rev Bd. 11–5–09. [7] ib. 11–5–09.

As all charges on account of the school are to cease on the first of December, the servants... will be discharged from that day. ... It is the Board's intention to keep these Boys for some days in the School buildings; ... some of them are mere children, and...there is no provision made against their immediate wants.

He further asked that pensions should be granted to Pereira,

the draughtsman attached to the school as Instructor in drawing, ... and Srenevassa Chatry, Bramin, the Malabar and Hindostanee Moonshee entertained also for their instruction. ... These two valuable servants have attended the school ever since its foundation, and have had ample Testimony of good conduct from Mr. Topping, Mr. Goldingham, and myself[1].

Pereira was granted a pension of 12 *ps.* a month from May 1811, but the Brahman was found to be already employed as one of the observatory assistants. Of the six boys remaining three were immediately found full employment by the Surveyor General, whilst it was reported that

B. C. T. Balfour has been altogether removed from the School at the request of his Mother, Mrs. Jane Balfour, and his indenture has been returned to her. Thomas Anderson is still subsisted at the school, and is employed in the Surveyor General's Office, and Charles Barnet has been permitted to reside with his mother in the Fort, where he has the advantage of attending a reading school for a part of the day, and of being employed for the remainder of the day in the office of the Commissary General[2].

The post of usher was abolished, and Scott was found work in the Surveyor General's office, whilst still holding charge of the younger apprentices.

MACKENZIE'S SUB-ASSISTANTS[3]

After passing through the school the apprentices joined one of three groups—those employed under Mackenzie on the surveys of Mysore and the Ceded Districts —those employed under Lambton on the General or Trigonometrical survey— and those employed on district surveys under the Tank Department or under Collectors.

The first to join Mackenzie was James Ross, who accompanied him to Hyderābād in 1798 [I, 286], and remained with him till passed to Mather in 1803. Geting into serious trouble the following year, he was discharged and sent down to the Presidency in disgrace [97], but to Mackenzie's disgust was taken into the Tank Department shortly afterward [164].

When Mather was appointed to the survey, he asked for two apprentices instead of the interpreter he had been allowed in Bāramahāl ;

Surveying requiring a man to be constantly on the move, and to often visit Hilly and unhealthy situations, and the boy I had formerly having thereby suffered much, I would recommend that 2 young boys should be taken from the Asylum to travel alternately ; it would then fall easier ; they would have practice combined with theory, and as being companions an emulation would arise, particularly if the terms of their Apprenticeship was to be limited to the time of their becoming Masters of their business. I am convinced they would soon become cheap and useful servants to their employers[4].

One of these boys was Michael Dunigan who became a capable surveyor and served nearly thirty years in the department. The other, Baillie, was a failure, and was replaced two years later by Henry Hamilton, who was a great success, becoming one of Mackenzie's best draughtsmen. Baillie was re-admitted to the school ;

His being returned from the Mysore Survey by no means would infer that he should be dismissed the Service. His return...to the Seminary at the Observatory...was from motives of humanity, ... to give the lad who was very young every further opportunity of improvement.

He obtained employment in Seringapatam in 1804, and was engaged by Mackenzie as an extra writer in 1809[5].

Mackenzie fully realised the value of these apprentices, and wrote to Mather who was going down to the Presidency for the monsoon ;

[1] M. Rev Bd. 10–12–10. [2] ib. 26–9–11. [3] For definition *v.* p. 347. [4] MMC. 6–11–1799. [5] DDn. 83, 4–8–10.

During your hours of ease at Madras I would recommend you forming a treatise on practical survey suited to this country, and your suggesting a plan of employing some young lads on executing the details of Provincial surveys under your own management[1].

Mr. Petrie, the senior Member of Council, is very desirous to give you every aid in his power in bringing forward your useful labours and, as I propose to Government in my report that four more boys from the surveying school should be attached to you (in all 6) as a kind of practical seminary of survey, I would recommend to you...to wait on him to mention your own ideas on the subject.

I would wish you to prepare a plan of a moderate establishment of this kind, including the horses, tentage, lascars, and monthly allowance, estimated in the most reasonable manner, the present allowance of 11 pagodas being calculated for the Collectors, who are stationary [349][2].

He wrote to Warren about the same time ;

I wrote you on 24th December last that no boys were then in a sufficient forwardness to be sent out from the school. ... Mr. Mather was allowed two boys in lieu of an interpreter's allowance...what assistance he derived from them I know not, but he acquaints me that one cannot be very useful in that line ; and from his age the other could not yet, I presume, be entrusted with any serious operation, though after some practice and experience I think they may be useful[3].

Benjamin Ward and William Scott joined in April 1801. Ward joined Mackenzie and in time became a first-rate surveyor ; he was given a commission in the infantry in 1810, and afterwards held charge of several important surveys. Scott joined Warren, and accompanied him to Lambton's survey, and then to the Observatory, where he became usher of the school [341].

In February 1803 two more boys, James Summers and William Howell, were sent up with Mather, whilst Mackenzie kept Dunigan and Ward down at Madras to help with the maps ;

I was only able, after all my exertions, to send in the works of the survey to Government last week, and there now only remain the General Plan of the surveys and of the Triangles for England, which are at the point of completion [102]. ... The last is a matter of some nicety and requiring great accuracy. As the lad Dunigan I conceived could be useful in assisting at some of the copying, I wish to retain him till the whole was sent in. I got Ward in the meantime permitted to attend the Engineer's drawing room ; this I hope will be of some advantage to his plan and map drawing, and also to Dunigan[4].

Being still detained at the presidency, Mackenzie sent Ross up to Mather ;

As he has been accustomed to the fatigue of the Field work with me, I hope he will be usefully employed with you in extending and filling up your Primary Stations in some of the smaller Districts or Subdivisions, as by employing such as you deem qualified on separate parts an emulation in the extent and accuracy of the work will naturally be beneficial to the Survey and advantageous to themselves.

Relying on your own experience and prudence, you will of course employ them in such manner as you judge best adapted for the general object of accelerating the Survey, ... by employing the most advanced & best qualified of the young men to fill up so much in detail on your Primary Stations ; but the Stations should previously be established by yourself.

Tho' I have accustomed him to keep a field book of the Roads & Boundaries on a certain plan, I would recommend your directing him to keep one in that method best adapted to your own method, for the sake of uniformity.

He further directed that the young men should not be detached too far from Mather's control[5].

By 1805 the apprentices were turning out useful work, and Mackenzie reports that, for want of a sufficient number of European Assistants, ... recourse was necessary to other measures to carry on the Geometrical work ; & one of the readiest...was to employ under my own immediate direction some of those whose previous instructions under Mr. Mather in the Elementary & Practical part prepared them...for the...Surveys of Roads, Rivers, laying down and sketching Ground & the great features of the Country, & their application to Military purposes. ...

In this manner since September 1804 two of these young lads at intervals were employed directly with me on the minute Geometrical Details, whilst the younger part (three) were with Mr. Mather [106][6].

[1] DDn. 66, 7-7-1800. [2] ib. 28-10-00. [3] ib. 14-8-00. [4] ib. 17-3-03. [5] DDn. 43, 14-9-03. [6] ib. 18-6-05.

He took great offence at being called on by Warren to submit a formal report on the work of these apprentices ;

I have acted near 15 years before Mr. Warren on the Company's Surveys ; ... even Mr. Mather is 6 years senior in this branch. ... I hope therefore every useful end may be obtained without departing from the accustomed regard to Seniority[1].

In 1807 William Lantwar was brought in as surveyor, having been employed privately as writer since 15th December 1799, and since Mather's resignation Mackenzie now became entirely dependent on the assistance of these young men [109–10]. He soon became reconciled to making periodical reports to Warren, who informed the Board of Revenue in 1808 that

Major Mackenzie speaks in favorable terms of the professional assistance which he has received from his Sub-Assistant Surveyors. But he complains loudly of their demeanour in several instances, as to want of respectful conduct, inattention to his orders, and in some cases of direct disobedience. Some of these young men, it would seem, presume on the circumstances of a want of communication between the Civil and Revenue Departments of Survey, and fancy themselves independent, in a great degree, of a principal which does not act under the authority of your Board ; A sort of conduct which requires immediate interposition as, although placed under a Surveyor, they are nevertheless...subject to the effects of your displeasure in the same manner as if placed under a Collector[2].

On being asked for further details, Mackenzie refused to press his complaints ;

Among the young men with me there are none at present but what I apprehend may be rendered useful ; I observe no fixed vicious habits, unless that unaccountable obstinacy in some that I must attribute to new ideas ; there is one of them to whom I may have to apply the remedy of a reduction of pay. I am averse to the mode of removal ; ... it would be immediately losing the benefit expected from their service ; I am rather for making them useful meantime by applying a remedy immediately when necessary.

Some of them deserve my best commendations ; Ward and Hamilton are with ease directed to the best purposes, and if errors have occurred in others, I am willing to forget it in their subsequent better conduct[3].

On close of the survey Mackenzie collected all six in Madras to work on the maps until early in 1809, when four of them, Dunigan, Ward, Summers, and Howell, were sent up to the Ceded Districts [153], followed by Hamilton and Lantwar a year later. A boy named Newman who had been recruited as draughtsman [156, 278] was sent to Lantwar later ;

He should remain some months with you for instructions in Practical Geometry, & afterwards in the easier first branches of Surveying, in order to qualify him the better for being a Draftsman of Plans, Maps, & Surveys ; & I propose, after he has been some time with you, to send him afterwards to Hamilton. ... I expect you will put him on some such course as Mr. Mather did yourself. ... He is not to have the management of Money while with you, as at his age it is not proper. He will give you the List of Apparel, &c. he brings with him, & you may assure him that his frugality, obedience, & diligence in learning his duties will entitle him to every reasonable encouragement from me[4].

A few months later Mackenzie wrote to Hamilton ;

I some time ago directed Mr. Lantwar to write to you to send Newman down hither as fast as possible, as I have occasion for him here, & I hope by this time he is well advanced on his journey. ...

I yesterday despatched Fred. Richd. Ficker, a young lad reared at the Surveying School, with Orders to join you as soon as possible ; he is a lad of good disposition, well instructed, & I trust will be of use to you on the Survey, ... while I expect at the same time that you will treat him with kindness & give him every possible instruction...and keep a vigilant eye to his Morals[5].

As the survey of the Ceded Districts came to a close, the sub-assistants were withdrawn to Madras for mapping, Dunigan being the last to come in [155].

Two other boys were apprenticed from the Orphan Asylum in December 1813, John Gould and John Mustie, and served for several years in Bengal.

Mackenzie's kindly interest in all these surveyors is well interested in the following letter;

[1] DDn. 43 (110) 18–6–05. [2] M. Rev Bd. 2–5–08. [3] DDn. 43, 15–6–08. [4] DDn. 83, 11–10–10. [5] ib. 21–3–11.

I beg to enclose the application of a young lad, the son of a deceased Capt. Lantwar of your Corps [352 n.1], for a grant of a house at the Mount built by his deceased father. ... A plan of the ground accompanies, taken by the young man himself. His mother is married to some European at the Mount, and can give you the necessary information. ... I have taken pains to get it this length to enable the poor people to establish their right to the property, and I dare say you will readily concur in doing this service to the family of an officer of your own Corps[1].

LAMBTON'S SUB-ASSISTANTS

In August 1800, shortly before moving up to Mysore, Lambton obtained two apprentices from the surveying school, Peter Lawrence and Joshua De Penning, and he reports in 1804 that "they are now competent in point of practice to every kind of calculation necessary in this complicated work, and are to me invaluable"[2]. Again two years later ;

It is almost impossible for me to do real justice to their merits, ... and I trust that when this survey may cease, they will be found invaluable acquisitions in conducting any service which the Board of Revenue may think proper to employ them in[3].

In 1804 two other boys, one of them Joseph Olliver, joined Kater, but returned to the school early in 1806. In March 1807 Olliver and William Rossenrode joined Lambton, and from 1812 when all his military assistants had been recalled [246, 322] till 1818, when he was joined by George Everest, Lambton had no assistants except these four. Lawrence had to be discharged at the end of 1817 [351], but the other three remained to do excellent work for many years whilst Olliver and Rossenrode left sons to continue their loyal service in the Great Trigonometrical Survey.

ASSISTANT REVENUE SURVEYORS

The majority of the apprentices were employed on district surveys, as had been intended from the first, either under the Collectors or under the Tank Department. There was a continued demand for their services, more especially after the final transfer of the Carnatic districts to the possession of the Company in 1801 [I, 107 n. 6 ; II, 139]. The most successful were Robinson, William Webbe, and Turnbull, but several had to be discharged.

Robinson was assistant instructor at the school from 1801 till in January 1807 he was sent to take over charge of the survey of Tinnevelly [141, 341], remaining till its completion in 1814.

In 1799, at the age of 15, Webbe accompanied Malcolm's first mission to Persia [I, 286 ; II, 173], and on his return was posted to Malabar

under Major Macleod [150], where I served under different detachments, in a very unhealthy climate, exposed to much fatigue and danger, till the rebellious state of the country made my service no longer required there[4].

He was then employed under the Collector of Madras—then at the school—till at the end of 1808 he was again deputed to join Malcolm at Bombay, and accompany him to Persia once more [175–6]. Returning to Bombay he was detained there "completing the surveys he made in Persia", and assisting Malcolm "to form a general Map of that Country". During the field season of 1811–12 he joined the Goa Survey for a few months [156–7], and then returned to Bombay to which presidency he was now permanently transferred.

Turnbull had started work in 1797 in Devicottai for the Superintendent of Tank Repairs [I, 108–9], being transferred in 1798 to Dindigul, and then to Madura in 1803. From 1805 till 1814 he held charge of surveys of Tanjore and Madura, taking up the resurvey of Dindigul in 1815 [140].

[1] To Lt Col. Freese, Mad. Art. ; DDn. 83, 18–7–10. [2] DDn. 63 (105) 24–6–04. [3] ib (147), 23–12–06. [4] M. Rev Bd. 27–11–06.

Early in 1807 revised regulations were issued for the surveying school and surveyors who had passed through it [341] and their designations were thus defined;

A boy who is of age and whose apprenticeship is over, an Assistant Revenue Surveyor.

An assistant who has served the Company twelve years from the date of expiration of his apprenticeship, a Revenue Surveyor.

And indiscriminately, when employed under surveyors who have gentlemen for their assistance, they are to be termed Sub-Assistants[1] to those surveyors.

Further rules were;

Although gentlemen employed in civil or military surveys are only accountable to Government for the mode in which they employ their sub-assistants, yet, as it is intended that the establishment of the institution be always kept compleat, but not to exceed twelve apprentices under a course of education, those gentlemen are not to discharge their sub-assistants without giving a previous and early notice of their intentions to the Superintendent of the Surveying School. ...

The Board of Revenue hold the Collectors who allow Assistants, having Sub-Assistants placed under them, to draw the pay and allowances of the latter, to be responsible that their confidence is not misapplied, there being too much reason to believe that Assistants frequently apply to their purpose that money which is designed for the support of their Sub-Assistants[2].

A curious commentary on this latter rule is given by Warren when reporting the good conduct of Lambton's sub-assistant Joshua De Penning,

and also the marked talents, assiduity, and good conduct of William Scott (who instructed the Boys in the practical survey now submitted to your inspection). I have...presented De Penning and Scott with a case of Mathematical Instruments and a silver medal each, with the inscription *The Reward of Merit and Application* engraved upon it[3] [341].

It is to be hoped that this first attempt to create emulation among the Assistants employed out of the School will turn their thoughts from what, I fear, was too often their object in wishing to be employed under a Collector in preference to a Surveyor, namely to defraud their Sub-Assistants from their salary, and to diminish the number of lascars which the Collectors credulously allowed them to entertain without number, in order to appropriate their pay to their own use[4].

The Inspector of Revenue Surveys carried out his supervision from the comfortable distance of the Observatory, so it is not surprising that professional work in the districts was seldom of a very high order, and Warren notes in October 1807 that

Pope and Faulkner have sent to this Office two plans and Field Books; the latter being more a minute revenue description of their Districts than a regular professional performance. Their plans are imperfect and bear no marks of accuracy. I feel, however, inclined to be indulgent on the merits of their work, considering that they are among the few who have sent anything to this Office for inspection, and that this...affords me the means of improving and correcting their practice.

Johnson has excused himself from sending any plan to be inspected on a pretence that he has no Colour Box. He adds that if one be sent him, he will then comply[5].

Another note explains Robinson's reference to various uncomfortable interviews with his Collector and unpleasant letters from Madras [142–3];

Owing to the salutory measures adopted by the Board with respect to John Robinson who is employed in the District of Tinnevelly, this young man, after having subjected himself to their censure, has now entirely amended, and for several months past has given every satisfaction to Mr. Hepburn. He has sent his Field Books, but no plan of his operations[6].

A strong tribute, on the other hand, was paid by Lambton to the good quality of the work done by these young surveyors [244].

In 1810 in addition to the two already attached to the Military Institution [342], Richard Long was attached to Garling's party on the survey of Kālahasti and Tirupati [127], and Samuel Godfrey was attached to the Quartermaster General's office.

General Hewett recommended the disbandment of the school and its establishment of revenue surveyors [139];

[1] This term also covered the juniors working under an Assistant on a District Survey. [2] DDn. 133 (302) 17–1–07. [3] A similar award was made to Peter Lawrence in 1808. [4] M. Rev Bd. 8–1–07. [5] ib. 26–10–07. [6] ib. 18–1–08.

It may be found impracticable to dispose at once of the whole of the young men educated in the Department of the Inspector of Revenue Surveys, but they can be gradually attached to other departments, and will most probably be provided for in that manner in the course of a short period of time.

Some of the young men...are employed under Collectors, and some are attached to Major Lambton, to the Superintendent of Tank Repairs, and to Major Mackenzie. The Establishment is useful, but by no means in proportion to its great expense. The young men attached to Collectors, for want of efficient control, are idle and dissipated, those under the Superintendent of Tank Repairs more numerous than can be employed with advantage, and those with Major Lambton perform the duties of Draftsmen[1].

On the abolition, therefore, of the posts of Inspector of Revenue Surveys and Superintendent of the school, all the district surveyors except those under the Tank Department and the Collector of Madras, were placed under the control of the Surveyor General [342–3]. Their number was to be reduced without causing individual hardship, and the Surveyor General was to inform those whose terms of apprenticeship had expired that

they are at full liberty to leave the service, whenever inclination or the opportunity...may occur ; but that they will be continued in the employ of the public on their present allowances if they chuse to remain, and that their services will be liable to be employed on whatever survey, or in such of the public departments as the Government may deem to be expedient[2].

At the time of this reorganization there were six apprentices still at the School, and 36 employed on surveys [163–4]. Of these

fifteen only were employed in the Revenue Department, that is under the Collectors and two Superintendents of Tank Repairs ; ... sixteen were employed under different Military Officers, and...the rest consisted...of a few Surveyors, either attached to the School or lately returned thither from duty in the Provinces[3].

There were not more than three or four resignations ; several were employed in the Surveyor General's drawing office, whilst others were posted to Goa to replace military officers [156], or were employed under Robinson and Turnbull to complete the survey of the southern districts.

The Collector of Tinnevelly protested against the Surveyor General's office sending instructions to the surveyors direct, but afterwards explained that he had received no Copy of General Order of October 9th ; that Major Mackenzie gave him to understand that he was still to control the surveyors in his district, and that their Pay is drawn under the authority of the Board of Revenue ; but that he himself is glad to be rid of the responsibility, and has directed the surveyors to correspond with the Surveyor General[4].

One of the assistant surveyors, Charles Campbell, accompanied the expedition of 1810 to Mauritius, and was employed on survey of the island, first under Robert Smith, and later

under the direction of Lieutenant Swanston of this Establishment, who I understand has since proceeded to England. ... His services, however, are not required in this Department, and if it should appear that he has procured employment in another line, which I think very probable, it might be advisable to strike him off the Surveying Establishment of this Presidency[5].

Campbell was shortly after given a commission in His Majesty's Bourbon Regiment.

PAY & ALLOWANCES

At the founding of the school it was ruled that the Superintendent should draw the sum of 100 Pagodas per annum for each of the boys ; ... this charge is considered a very ample allowance, and...it may be understood to include every contingent charge of whatever description incidental to the Establishment[6].

This allowance originally applied to an establishment of twelve boys, and by the custom of the times both Goldingham and Warren drew the full 1,200 *ps.* whatever the actual number of boys present[7]. The Superintendent drew a further 50 *ps.* a

[1] De Penning and Lawrence had already been employed on observations and recording of triangulation [243]; DDn. 84 (93) 27–8–10. [2] MMC. 29–1–11. [3] DDn. 127 (4) 29–4–11. [4] ib. 17–12–11. [5] M. Rev Bd. 21–11–11 ; MPC. 11–6–13. [6] M. Rev Bd. 5–6–1795. [7] Warren was unfortunate in being brought to book on this count, & made to refund the excess drawn ; *v.* correspondence closing with M. to CD., Mil., 29–5–18 (188–9), and CD. to M., Mil., 28–6–20 (13).

month as personal salary, besides a grant as Inspector of Revenue Surveys limited to 100 *ps.* a month [299–300].

The boys were apprenticed to the Company for seven years, a few for only five, being clothed and fed by the Company. The Collectors were allowed 11 *ps.* p.m. each for their maintenance [I, 285 ; II, 344]. In 1801 it was decided to continue this provision after the expiry of the seven years ;

On the institution of the surveying school, the lads were selected from the Male Asylum at an early age, and apprenticed for a period of seven years only. By apprenticing them so young, and for so short a time, two inconveniences result. In the first instance, they become their own Masters at a time of life when they are incapable of judging properly for themselves, and are liable to contract vicious habits, which their youth and inexperience expose them to ; further, the greatest part of their period of indenture expires while they are still under tuition, and the Company benefit only by their services during the remaining unexpired term, when they consider themselves at liberty to follow their own inclinations.

We recommend that those lads whose period of apprenticeship shall expire be still kept under the immediate control of the Superintendent...until they arrive at the age of twenty-one, by which time it is fair to suppose that they will have acquired an industrious turn, and become useful Members of the Community[1].

It was then ordered that after expiry of apprenticeship the boys should draw a monthly salary of five *pagodas* until they reached 21 years of age, their expenses continuing to be paid by the Superintendent.

In 1803 the salary allowed to those who came of age was increased from 16 to 25 *ps.* a month, with 4½ extra for the keep of a horse. On this they had to keep themselves, though Government provided "a small horse", and also

a Marquee and a private tent, both very small, ... with carriage for the same, and lascars, to convey the Surveying Instruments and put up the tent, ...six of these[2].

The revised regulations of 1807 ruled that the boys should,

if under 14 years of age, be bound apprentices to the Company until they were of age, and if older than 14 they are to be articled as heretofore for seven years. ...

Collectors and Surveyors who have boys from the Surveying School under them are allowed to draw as follows on their account :—

A Sub-Assistant who has not served his time, under 18 years of age ...	Star Pagodas	...	11
An Assistant who has served his time, and is of age	,,	..	25
A Sub-Assistant who has not served his time, above 18 years	,,	...	16
An Assistant who has served six years from the expiration of his apprenticeship, if reported an expert surveyor, and if his conduct be favourably represented, ... when actually employed ; ... a salary of	,,	...	35
A Surveyor who has served twelve years (as in the previous case) ...	,,	...	45

N.B.—The three latter are to supply themselves everything on their salary, excepting as stated hereafter. The increase of pay...to 35 to 45 Pagodas per month is however by no means to be considered as a matter of right. ...

A Revenue Surveyor who may have served the Company zealously, and to the satisfaction of his superior, for a period of twenty years from the date of the expiration of his apprenticeship, shall be allowed to retire on a pension not exceeding the half-pay of his situation. ...

Every individual belonging to the establishment, when on actual survey and not otherwise, is allowed (besides his salary) for Horse Allowance, Star Pagodas 4½.

Sub-Assistants who draw only 11 and 16 Pagodas per month are allowed one cooly to carry their baggage, for which the Collector is allowed to draw monthly 2 Pagodas.

When an Assistant and Sub-Assistant are detached together they shall be furnished with a Subaltern's tent, for which the Collector or Surveyor will draw the usual allowance of star Pagodas 14.

Should an Assistant have two Sub-Assistants with him, he is to be allowed an additional private tent, as he may have frequent occasion to detach either of them. For this the Collector will be allowed to draw a monthly sum of Star Pagodas 7.

A Revenue Surveyor or Assistant placed alone under a Collector or Surveyor will be allowed three surveying lascars. An Assistant having a Sub-Assistant under him will be allowed five surveying lascars. ...

When a boy's apprenticeship has expired, and it is proposed to employ him as an Assistant Surveyor he is in future to enter into an obligation by which he binds himself to serve the Company in that capacity for four years.

[The tent allowance provided for bearers to carry the tents, and each sub-assistant drawing less than 25 ps. was allowed one cooly for his private baggage].

[1] From Rev Bd., MRC. 31-7-01. [2] M. Rev Bd. 31-12-04.

List of clothes and other necessary articles to be furnished to an apprentice or sub-assistant surveyor ordered on service, exclusive of his old clothes.

6 Shirts
6 Pantaloons
6 Sleeved Jackets
6 Handkerchiefs
6 Waistcoats
6 Towels
4 pair long drawers (Gingham)
1 Blue Jacket
2 Pillow cases
1 Straw hat, covered with white cloth
2 Sheets
1 Mat
1 Pillow
1 Camp Cott
1 Table, 3 feet by 2½
1 Country Horse, with saddle and bridle

Sundries

1 Trunk
1 Looking glass
2 Combs (small tooth)
2 Spoons
A Knife and Fork
2 Pewter Plates
2 Cups and Saucers
2 Tin Pots
1 Lanthorn
1 pair of scissors
6 cakes of Soap
1 Rattaned Guglet
1 Coat Brush
1 Shoe Brush
3 cakes of Blackball
Five Pagodas in ready cash.

Three coolies at the rate of 2 Pagodas per month each are allowed to carry the above until the boy reaches his station, when they are to be discharged[1].

The following is an account actually submitted to a Collector in 1804 for a month's personal expenditure[2];

	Ps.	*Fs.*	*Cash*
	[330 n.1]		
To 1 Servant's pay for Feby. & Batta for 9 days	2	13	40
1 Cook's do. do.	2	13	40
1 Horsekeeper's do. do.	2	13	40
1 Grass cutter's do. do.	1	34	40
Washerman and Ironman	1	21	00
Expence for the Horse	3	21	00
My Table expence	10	00	00
Shoes, &c.	1	00	00
House Rent	4	00	00
1 Peon's pay & Batta for 9 days (for escorting the Hon'ble Company's surveying Instrument)	0	37	64
Pagodas	29	28	00

Extra Charges in the month of Feby. and for the Journey to Madras :— ...

	Pagodas		
4 Flat plates ...	0	24	00
4 Dishes	1	30	25
4 Cups and saucers ...	1	6	0
Tea, Sugar, and Milk pots ...	1	6	0
3 pairs of knives and forks ...	1	10	40
4 Tumblers	1	18	0
1 Kettle and Lanthorn ...	1	30	0
1 Large-&-small tooth Comb ...	0	30	0
A pair of scissors & some needle and thread ...	0	21	0
2 Blacking Cakes	0	24	0
1 Coat & Shoe Brush ...	0	36	0
1 Dozen of Candles ...	0	30	0
6 yards of Hair Ribbon ...	0	24	0
1 Country Box	0	36	0
	12	31	65

NOMINAL ROLL

The following is an alphabetical list of the boys who passed out from the school [I, 284] with a summary of their subsequent employment.

Name	Birth[3]	Apprenticed	Employment	Casualties
AIKIN, James	Oct. 1789	1803	Tanjore, 1805–10 ; Madura, 1811–4 ; Dindigul, 1815.	to Bombay, 1823 ; ret. 1833
ALLAN, James	May 1782	1794	Devicottai, 1797–8 ; Dindigul, 1798–1804 ; Tank Dept., 1805–10 ; Tanjore ; School, 1810 ; Tank Dept., 1811.	dism. 1–7–11 ; " a useless servant"
ANDERSON, Thos.	June 1796	1810	SGO. Madras, 1812.	
BAILLIE, Chas.	Sept. 1785	1797	Mysore, 1800–2 ; School, 1802–3 ; other employment, 1804–10 ; School, 1810; SGO. Madras, writer, 1811–4.	resd. 1804; re-employed 1810
BALFOUR, Benjamin Cramer Fredk.	June 1797	1809	removed from the School, 1811.	d. Nilgiri Hills, 1825
BARNETT, Chas.	June 1800	1809	SGO. Madras 1812.	with Nellore Svy. 1843

[1] DDn. 133 (302), 17–1–07. [2] M. Rev Bd. 23–4–04. [3] Evidence not always consistent.

NOMINAL ROLL—(*Contd.*)

Name	Birth	Apprenticed	Employment	Casualties
BIRD, Wm.	March 1793	1805	Tank Dept. 1807–9 ; School, 1810 ; Tinnevelly, 1811–3 ; Pudukkottai, 1813–4 ; Dindigul, 1815.	d. Ellore, 30–12–20
BURKE, Marcellus	June 1792	1806	Mil. Instn. 1810 ; Goa, 1810–2 ; Sonda, 1813.	to Bengal, 1818 ; with DSG. Rev. Svy. 1831
CAMERON, Wm.[1]	March 1789	1807	Tank Dept. 1810.	d. Nīlgiri Hills, 11–7–25.
CAMPBELL, Chas. Mackenzie	March 1793	1807	Mauritius, 1810–12 ; Bourbon, 1812–3.	2/Lt. HM. Bourbon Regt. 1814
CHAMARETT, Andrew Several generations followed in survey.	March 1793	1805	Tanjore, 1809–10 ; Madura, 1811–4 ; Dindigul, 1815.	m. Secunderābād, 3–10–20, Katherine Johaness, spin.; d. Poona, 18–12–48
DAVID, Thos.	Sept. 1783	1794	Vizagapatam, Sept. 1798.	d. *c.* 1799
DE PENNING, Joshua *v.* Bio. Notes.	9–8–1784	1798	With Lambton, 1800–18 ; GTS. 1818.	resd. 1824 ; re-employed 1832–43 ; d., Calcutta, 2–3–45
DUNIGAN, Michael	May 1784	1798	Mysore, 1800–8 ; Ceded Districts, 1809–14 ; SGO. Madras, 1814.	ret. on pension, 1826
FAULKNER, John	March 1785	1803	Trichinopoly, 1805–10 ; School, 1810–1 ; Java, 1811–2 ; SGO. Madras, 1812–3 ; Sonda, 1813–5.	
FICKER, Fredk. Richd. possibly son of Henry Ficker, appd. Conductor 1790 ; at Negapatam 1803.	Dec. 1792	1807	Ceded Dists. 1811–3 ; SGO. Madras 1813.	m. Amelia — ; father of John, b. 2–2–24 ; d., Madras, 28–12–26
FLETCHER, Wm.	March 1786	1803	Madura, 1803–6 ; Tinnevelly, 1807–11.	dism. 1812.
GARDNER, Robert	Jan. 1781	1794	Dindigul, 1796–8.	d. 1798
GODFREY, Samuel	April 1784	1794	Vizagapatam, 1798–1806 ; Coimbatore, 1807 ; Madras, 1806–10 ; QMG.'s office, 1810.	resd. 1810
HAMILTON, Henry	May 1786	1800	Mysore, 1802–8 ; SGO. Madras, 1808–10 ; Ceded Dists., 1810–3 ; SGO. 1813–5.	to Bengal, 1818 ; d. Calcutta, 6–6–26
HILL, Thos.	March 1786	1803	Tinnevelly, 1807–13 ; Madras, 1814.	d. Madras, 20–3–46
HOWELL, Wm.	March 1791	1803	Mysore, 1803–8 ; Ceded Dists., 1809–13 ; SGO. Madras, 1814.	to Bengal, 1818 ; resd. 1819 ; living, Madras 1851
JELLY, Joseph	April 1789	1803	Tank Dept., Nellore & Arcot, 1805–15.	
JOHNSON, John Ambrose	Sept. 1779	1794	Madura, 1797–1800 ; Dindigul, 1800–4 ; Madura, 1804–10 ; at St. Thomé, 1807 [141] ; Madras, 1810.	m. Madras, 29–11–06, Miss Elizabeth Morgan
KEYES, Wm.	Oct. 1789	1803	Coimbatore, 1807–13 ; Pudukkottai, 1813–4 ; Dindigul, 1815.	d. Calicut, Feb. 1825
LAWRENCE, Peter Had wife and 5 small children 1817.	Aug. 1783	1797	with Lambton, 1800–18 ; SGO. Madras, 1818–20.	disch. 1–1–18 ; re-employed ; d. 21–10–27
LINCOLN, Henry	June 1780	1794	Tank Dept. 1798–1815.	
LONG, Richd.	26–7–1791	1805	Mil. Instn. 1810 ; Goa, 1810–2 ; Sonda, 1813.	d. Secunderābād, 7–10–55. MI.
MACKAY, George	Sept. 1794	1805	Tanjore, 1809–10 ; Madura, 1811.	d. 1811
MACMAHON, Chas.	Oct. 1791	1803	Coimbatore, 1809–13 ; Pudukkottai, 1813–4 ; Dindigul, 1815.	in ch. Salem Svy. 1844
MACRAE, John	June 1788	1803	with Collector, Madras, 1806–9.	d. Madras, 22–4–10
MALCOLM, John possibly nat. son of Sir John Malcolm (1769–1833).	March 1793	1807	Java, 1811 ; SGO. Madras, 1812 ; Sonda, 1813 ; resd. 1819 ; re-admitted 1822.	Cornet, Skinner's Horse, 1819–22, d. Bombay, 19–12–37

[1] m., Madras, 17–5–15, Miss Sophia Burnaby; but identity uncertain.

NOMINAL ROLL—(*Contd.*)

Name	Birth	Apprenticed	Employment	Casualties
MARTIN, Francis Louis (or Lewis)	Dec. 1786	1800	QMG.'s office, 1804–10.	refused to work under Blacker; dism. 1810 d. Madras, 26–4–36;
MEAD(E), Wm.	March 1793	1803	Tank Dept. 1807.	d. Madras, 31–12–36
OLLIVER, Joseph Had several sons in GTS.	June 1785	1800	with Kater, 1804–6; Lambton from 1807; GTS. 1818.	pension 1842
ORTON, Duke	1786	1799 ?	Tinnevelly, 1802–6.	disch. 1–12–06
PEREIRA, Christian	Nov. 1790	1803	Madura, 1805–10; Tanjore, 1810; Madura, 1811–4; Dindigul, 1814.	m., Dec. 1817; d. Travancore, 20-7-18 bur. Ninda-Kura, Quilon
POPE, Sylvester Service with Micheal Topping from 1791	April 1781	1794	Persia, 1799–1801; Malabar, 1802–4; Tanjore & Trichinopoly, 1804–10; sick, 1810–1; Madras, 1812.	d. Madras, 25–11–18
READ, Andrew	Nov. 1782	1798	Tinnevelly, 1802–6.	dism. 1807; d. Madras, 3–2–10.
ROBINSON, John	Jan. 1782	1794	School, asst. instr., 1801–6; Tinnevelly, 1807–13; Rāmnād, 1814, to Tank Dept. 1815.	m. Madras, 8–12–1799, Sophia Rosara; d. Madras, 24–2–1848. MI.
ROSS, David	Oct. 1788	1803	Tank Dept., 1806–10; with Supg. Engr. Madras, 1810.	d. Madras, 22–11–25
ROSS, James possibly son of James Ross, soldier, who d. Madras, 10–12–06, and bro. of David [*sup*].	June 1781 ?	1794	Hyderābād, 1798; Mysore, 1799–1804; Tank Dept. 1806–...	
ROSSENRODE, Wm. His son followed him in survey.	March 1792	1805	With Lambton from 1807; GTS. 1818.	m. Masulipatam, April-May, 1814; ret. 1841.
SCOTT, Wm. Several generations followed in Survey. *v.* Bio. Notes.	July 1784	1799	Mysore, 1801; with Warren to Lambton, 1802; Observatory, 1805; School Usher, 1807–11; SGO. Madras, 1811–6.	m. Nov. 1810; d. May 1827, Calcutta
SUMMERS, James Several sons in survey.	20–3–1789	1800	Mysore, 1802–8; Ceded Dists. 1809–13; SGO. Madras, 1813.	pension 1819; d. Madras, 23–12–32
TERRY, John	April 1792	1803	Mil. Instn. 1809–10; Goa, 1810–3; Sonda, 1813.	d. Hyderābād, Sept. 1819.
TURNBULL, Thos.	Feb. 1781	1794	Devicottai, 1797–8; Dindigul, 1798–1804; Tanjore, 1805–10; Madura, 1811–4; Dindigul, 1815.	d. 2–6–31
WARD, Benjamin Swain *v.* Bio. Notes.	June 1786	1798	Mysore, 1801–8; Ceded Dists., 1810–3; SGO. Madras, 1811–6.	Ens. Mad. Inf. 27-8-08; d. Capetown, 19–6–35; MI.
WEBBE, Chas. probably bro. of William [*inf*].	Sept. 1782	1794	Dindigul, 1796–8.	d. 1798
WEBBE, Wm. Son of Sergt. Webbe, of Madras Est. *v.* Bio. Notes.	April 1784	1794	Persia, 1799–1801; Malabar, 1802–4; Madras, 1804–7; School, 1807–8; Persia, 1809–10; Bombay, 1810; Goa, 1811; Bombay, 1812.	to Bombay Est., 1812 still serving 1830

Besides these boys from the surveying school, Mackenzie collected a few from other sources [156, 278], including

Lucius Rawdon BURKE, clerk, the first Registrar to the Surveyor General; d. Calcutta, 13–4–29; leaving sons with the survey.

William LANTWAR[1], engaged as writer from 15–12–1799; asst. surveyor from 1807; d. Madras, 29–5–17, leaving a widow, son, and 2 daughters [110, 156 n.3].

John NEWMAN, engaged as draughtsman *c.* 1808; d. Madras, *c.* Aug. 1818.

These three, whom Mackenzie paid for some time from his own salary, and regarded as his personal staff, accompanied him to Java and Bengal, 1811 to 1815.

[1] Son of Wm. Lantwar, Mad. Art.; Ens. 1779; Capt. 1784; d. 1789 at the Mount.

CHAPTER XXV

PEOPLE & COUNTRY OF INDIA

Indian Surveyors & Explorers — Writers & Interpreters — Lascars & Followers — Escorts — Care of Health — MEN & MANNERS; Upper India — Mysore — Lambton's Survey.

WE have told of the Indian surveyors, or explorers, sent out by Reynolds to collect material for his map, and how that on leaving India he pensioned them off, leaving Rs. 22,000 with his agents for the purpose [I, 288–9]. On hearing of this the Directors took over official responsibility, but settlement was not concluded without long correspondence, which dragged on till 1825, six years after Reynolds, and most of these surveyors, had died[1]. In no other case was the employment of Indians openly approved by the Directors or by local governments in India, though most surveyors working in the wilder regions were only too glad to make use of such help.

Colebrooke, as Surveyor General, encouraged every means of gathering information, and in 1804 he writes to Crawford, who was then commanding his battalion at Sultānpur[2] ;

A Native has written to Lucknow for me, to procure routes from that place to Pilleebeet[3], ... and other places. Should you meet with any intelligent Hindus at Sultanpoor who have visited the spot where the Ghogra, or Sarjoo, issues from the hills [26][4], and which I understand is a place of worship [32], a route to that place would be desirable ; or you can despatch thither the man who is already gone to Butool, after his present excursion[5].

On going up country himself in 1807 he took "two Native Assistants", who explored routes he was unable to travel himself [28–33][6].

White's map of Shekhāwati[7] and Bikaner included "information...from a very intelligent native who traversed the Country in various directions, and kept a Journal of his route"[8] ; whilst Tod writes that

for some time past I have been instructing a very respectable, enterprising, Native in the mode of keeping a journal and the use of the Compass. He is directed to proceed direct to Udipur ; from thence West to Hyderabad...on the Indus, visiting in his way the source of the Banas R., which I believe to be about 25 or 30 Coss W. somewhat North of Udipoor. From Hyderabad he proceeds along the bank of the river to Multan, and is to return from thence by Jusselmair...to camp.

It is doubtless an arduous task, but I hope from the spirit of enterprise the man possesses he will overcome all difficulties. He only waits for the arrival of bills of exchange from Jaipur on Multan to depart, and they are daily expected.

A pair of Marwar[9] Hercarrahs at the same time leave this for Jesselmer, and proceed W. to Bukr [271] on the Indus, and return in as direct a route as is practicable to Udipur[10].

Both Lloyd in Nāgpur, and Tod in Rājputāna, employed a number of *harkaras* collecting routes [53–5], and Tod spent a considerable amount of private money on them. Webb also employed men to collect accounts of routes into the mountains, and this led the Surveyor General to put the matter before Government ;

I caused one of the Routes...to be translated from Persian, and conceive they will all be of great use. These native surveyors work hard for small pay ; they can penetrate into parts of the country inaccessible to Europeans, and collect valuable information. ...

[1] Bo MC. 18–10–20 & CD to Bo. 5–2–23 (50), *et seq.*, to mil. letter No. 18 of 9–2–25. [2] 63 J/3. [3] Pīlībhīt, 53 P/14. [4] The Sarda, or W. branch of Gogra, issues from hills 62 C/4 ; Karnāli, E. branch, 62 H/6. [5] Butwāl, 63 M/6 ; DDn. 67 (489), 15–2–04. [6] Bareilly to Benares, July to Sept. 1808 ; Fdbk. MRIO. M 323. [7] N. district of Jaipur State, 44 P, 45 I, M. [8] DDn. 82 (35), 11–10–08. [9] of Jodhpur. [10] ib. (70), 9–1–09.

The charge mentioned by Lieut. Webb has actually been incurred; this officer was prevented from protracting the work by severe indisposition. ... Lieut. Lloyd...has sent me two protractions of Routes laid down by him from notes of an Hircarrah who he has taught, containing very valuable information concerning the sources of the Sone and the Nerbuddah rivers, erroneously stated by Major Rennell to spring from the same source [I, 30], whereas they rise at least twenty-five miles distant from each other. And Lieut. Tod..,has employed a man who appears to be very intelligent, and capable of filling up intervals between his measured lines with great accuracy.

There can be no doubt of this method of procuring intelligence being very economical, the expense being trifling, but I do not consider it respectful to encourage it without the express sanction of the Right Hon'ble the Governor General in Council[1].

The Military Accountant General did not like the idea, as he found no precedent for allowances having been granted to any native for taking a Survey. Although a Surveyor may accidentally find some people of his Establishment capable of performing a part of his duty, & may take upon himself the responsibility of employing them, I do not therefore perceive sufficient cause for burthening the public with any additional expence.

On his advice the Surveyor General was told that the employment of natives in taking Surveys...is a practice which Government are by no means disposed to encourage, or to authorise any remuneration to be made for such Services [340][2].

Some time later Hodgson, who was very much interested in the geography of the mountains, submitted a Route taken by a Man whom I have engaged in my service, from Falour[3]—Lat. 37° & abt. 6½ miles N. from Ludiannah—...Nthly. between...the Tartarian Mountains—nearly East to the famous Mansoar Lake [78–81]—& hence in N. Westerly direction to Ludack, ... near the Ravvee River[4]. ... Thence S. a little West to Argund, ... & thence by Jumboo[5], (mentioned in Forster's Journey [I, 233]), down to Falour. ...

I dare not vouch for the correctness of this route, but I have reason to believe that the Man tried to go to Maansir himself, but suspect that the remainder of the Journey back he may have got by information. He is a Bramin, & was formerly in the Service of Lieut. Webb, who says he taught him something of the use of a Compass, but I found him deficient & gave him some instructions. The man is intelligent and enterprising, writes Hindee, some Persian, & a little execrable English, & has [posed] as a Pilgrim & Native Doctor, with Medicines for those who are so unfortunate as to become his Patients.

He brought some Specimens of Gold Dust from the Sands of the Rauvee, and several Trinkets of Gold made there, & is of some Substance, having several Attendants.

I endeavoured at Meerut to get an Astrolabe or small Quadrant for him, meaning to teach him to take Altitudes of the Sun and Stars, that I might check his future routes (but I could not get such a thing), & to send him off to resurvey this route, & to make him purchase a compass himself. When near Meerut I was taken very ill & obliged to go there for Medical Assistance, & was for some time too ill to speak to anyone, & this man then, either honestly misunderstanding me, or being impatient to be gone on his journey, went on it, having himself purchased...a good compass in one of the shops for 60 Rs. ...

I regret his going away without the further Instruction I meant to furnish him, & also a pedometer. When this man returns I will protract his route which I do send now, not caring to put anything in the shape of a Map for which I haven't satisfactory Authority. ...

The Bramin says he had, & used, a Compass as far as Udsein, 8 Coss N.E. from Burmour, & that it was there broken. I doubt his having had one, & indeed much of his Story, but such as it is I send it for want of a better, trusting it may not with due allowance be altogether uninteresting.

I had some thoughts of sending him by Cashmere to Cash Ghur[6], which I suppose is abt. 40 Journeys from Cashmere, ... to get some Idea of the Distance & Route to the nearest part of the Russian Dominions, but, apprehensive that he might attempt to pass himself for an authorised Agent of Government, & misbehave, ... I gave up the Idea for the present[7].

Hodgson further records that he obtained several routes from Colonel Ochterlony, "taken by an intelligent man in his service, from Ludhiannah to Cashmere, Ladack, & I believe Kashghur"[8]. Buchanan records that he employed "a slave of the Raja of Gorka" [72] to construct a map of Nepāl, and also in the rainy season of 1814...employed Hariballabh, a Brahman born in Kumau[9], but has

[1] DDn. 128 (57), 7–3–12. [2] BMC. 11–4–12 (31). [3] Phillaur, 44 M/16. [4] really the Indus. [5] Jammu, 43 L/14. [6] Kashgar, 42 M. [7] DDn. 130 (93), 14–11–13. [8] DDn. 136, 28–5–14. [9] Kumaun, 53, O, 62 C.

long been in the service of the Garhawal Rajas, and has travelled much in the adjacent parts. A map of the western parts of the dominions of Gorkha, now also in the Company's library, was composed by Hariballabh, with the assistance of Kamal Lochan. The same person gave me another map explaining the country which extends some way west from the Sutluj[1].

Hodgson's enthusiasm was doomed to disappointment, for the Survey General regretfully wrote that

the Government have now notified to me that they wish to throw cold water on all natives being taught, or employed in making Geographical discoveries. ...

Captain Tod...taught and employed natives to go with Compass, Perambulators, & Pedometers, and, after collecting a valuable set of Routes which were regularly forwarded to this office, he could not without the greatest trouble get any remuneration. ... and was thus desired to discontinue the practice[2].

Lloyd was also stopped from sending out *harkaras* on survey "as Government were anxious to prevent the Natives from obtaining, or being taught, any knowledge of the kind"[3].

Fifty years later this official distrust had been recognised as a bogey, and surveyors were allowed to enlist them for special purposes. There were disappointments from time to time, but Indian surveyors have made noble contributions to our knowledge of India, and of trans-Himālayan regions in particular.

The only record of Indian surveyors being employed in the south, other than men of the Madras corps of Guides [122–3], is one of several routes surveyed in Travancore by "Hakhad Coonum Coolungarry", submitted by Arthur in 1811 [131–2][4].

In the published account of his mission to Persia Harford Jones includes several maps, one of which is stated to be

an original idea of a map by a Persian, who, in consequence of the natural ability he evinced, was afterwards employed by Col. James Sutherland in taking various routes through the country [176][5].

Amongst many Indians employed on revenue surveys [181–2], Dickinson had "a Native Assistant practised in Land Surveying, on a salary rupees Twenty five per month, also 2 measurers Rs. 12 each"[6].

WRITERS & INTERPRETERS

Except for a few draughtsmen, we have little record of the employment of Indians on office duties in Bengal at this period, but in Madras a large establishment was kept up by Mackenzie owing to the variety of languages in which vernacular records were kept. Interpreters and translators were required for the collection of statistical information [93, 107], and also for the historical researches on which, with Government encouragement, Mackenzie devoted a large amount of his time and energy [111, 153].

When he started the survey of Mysore, his establishment comprised a European writer[7] and a draughtsman with

1 Head Interpreter and Translator on Pag. 30 ; 1 Canara Interpreter on Pag. 5 ; [whilst a] mounshee for the Persian language will occasionally be required, and an extra Writer and Draftsman at the end of the surveying season. ...

The pay here proposed as Head Interpreter for Cavally Boria, a Bramin employed by me for several years, is suggested rather as a mark of approbation of the fidelity and attachment he has manifested for several years, ... and to defray the expence of several people occasionally assisting him[8].

Cavally Venkata Boria died on 7th January 1803, and was succeeded as head interpreter by his younger brother Cavally Venkata Lechmya [pl. 22][9]. By 1808 after the close of the Mysore Survey, Mackenzie was employing about a dozen

[1] Hamilton (3, 5). [2] DDn. 135 (32), 2–12–13. [3] ib. (8), 23–7–13 [4] DDn. 127 (32), 22–7–11. [5] Brydges, pl. I. [6] Bo RC. 8–7–12 & 2–2–14. [7] L. R. Burke [303]. [8] MMC. 4–2–1800. [9] BPC. 26–7–04.

interpreters, on pay varying from five to forty *pagodas* a month[1].

C. V. Lechmya, Bramin. Head Interpreter & Translator.
Abdul Aziz, ... and extra Persian Translators.
Baskeiah, Bramin, ... and two others ; Canara Interpreters.
Durmia & his son [Jains] ... ,, ,,
Moba Row, Bramin...and Seva Row ; Mahratta Interpreters.
Ramaswamy, Bramin [brother to Lechmya] ; Tellinga Interpreter.
Sreenevassiah, Bramin ... Tamil ,,
Swaramia, Bramin ... Saastree ,,

The merit of some individuals has been of great utility in this work, and...for several years back, & gives claim to some permanent provision ; the formation of this part cost much time, & its dissolution must be viewed with regret. ... The Principals could be usefully employed assisting on various branches, from their general knowledge of upwards of 10 different Dialects used under this presidency[2].

He made special provision for

the family of the deceased C. V. Boria, Bramin, the Principal Interpreter on the Mysore Survey, and previously in the Dekan, to whose ingenious conciliatory talents much of the successful results from native intercourse may be fairly inferred. Both himself and his younger brother died on this service, leaving families unprovided for, and to the zeal and fidelity of the surviving brother, C. V. Lechmya, Bramin, I consider myself indebted for following up with effect the Plan traced out by his brother for investigating the Civil & Religious Institutions of those Countries[3].

Lechmya[4] not only served till Mackenzie's death, but afterwards spent some years arranging the celebrated collection of manuscripts left at Madras. The subsequent history of this talented family is typical of many disputes of Indian family life. Boria and Lechmya had an elder brother Narayanappa and two younger brothers, Venkata Ramasami and Cavali Sitayya. They also had a sister who married the *zamīndar* of Vissanapet, who borrowed money from his brothers-in-law. On the *zamīndar's* death in 1810, the brothers continued to advance money to their widowed sister.

In due course legal proceedings ensued as to the succession to the Vissanapet estate, and were actually carried to the Privy Council where, in 1867, the estate was finally assigned to the descendants of Boria[5].

Before Lechmya left Madras to join Mackenzie in 1817 in Bengal, he became involved in litigation over money matters, to Mackenzie's great distress. He writes to Riddell from Calcutta of his complete faith in Lechmya's honesty ;

With this integrity and accuracy in accounts then, you will naturally ask how he comes to be so deeply involved, & this I will endeavour to account for. The 4 poor brothers when they came to my service were the youngest of a numerous family that, tho' of considerable respectability in their own class, were absolutely ruined. They had no property whatever, & all the pay I could afford for many years could little enable them to assist & support their mother, younger brothers, & the families of three elder ruined brothers. From Pagodas 15 to 20, 25, & finally 35, was the utmost they had, & this was little enough to support 7 or 8 families at Ellore, Masulipatam, & Madras, while these poor people travelled with me for several years.

The consequence was that when I went to Java, I believe Lechmyah was then in debt. ... At that time I believe he committed his first false step. I had designed for him a certain commission in the Barrack Department. ... I think that his relations urged him to get this money invested in lands, with the prospect of profits that was fallaceous, ... & I am afraid the money was swindled out of his hands. ... The advance I made turned out equally fruitless. ... He had debts that pressed on him. ... Another thing that involved him in expence was a Law suit...which ultimately failed. We were of opinion his family was unjustly dealt with & swindled out of a Village. ... I am deeply interested in his welfare.

I only wish he could be got round here, ... because, if he could save a little from his pay here, & in two years return from hence to his village & the House I bought for him at Madras, he might live in quiet. ... To mortgage the Village newly granted to him is very mortifying, but what is to be done else ? ...

I also wish enquiry to be made as to the disposal of the money given to him in 1810 to

[1] DDn. 33, May 1807. [2] DDn. 43, 29–7–08. [3] ib. (263), 23–2–09. [4] formal spelling Lakshmiah.
[5] *Kistna Manual* (338).

purchase lands in the Circars. I understand it was lent to a Zamindar, a Sister of his, & the Perwannah for it was in my hands some time. ... I had my doubts of some of his Friends. ...

I cannot help still being uneasy for the poor man, knowing the nice sense of disgrace they attach to being put in Gaol[1].

Mackenzie was allowed to maintain this establishment and continue his collection of historical manuscripts whilst his assistants carried on the survey of the Ceded Districts. No fewer than 13 interpreters were borne on the strength of the survey from 1810, one of them being Narain Rao who accompanied Dunigan and Ward [153]. The following notes are typical of Mackenzie's consideration for his staff. In a letter addressed to Lechmya regarding Narain Rao he writes ;

You should tell him I order a Shawl for him for the New Year's day as a mark of my approbation, & I will write to Mr. Ward today to pay the amount of it in Canoul, or where it may be most satisfactory to him, & a Cloth to his Assistant[2].

To the head surgeon at Bellary he writes ;

May I request you will have the goodness to give your best advice and Medical aid to my Servant Narrain Row & his companion ; they have been taken ill at Comply of fevers, & I have recommended to them to get up to Ballary as fast as possible[3].

He obtained a pension for the widow of one of his Bramin Interpreters, Sooba Row, who had served unremittingly with the Mysore survey from its first commencement in 1799, and whose health had suffered in consequence, having died on the 15th December last, leaving an aged mother and wife and a female child unprovided for, and in distress. ... I have included the sum of Pagodas 4 per month in the estimate as pension for this distressed family. The amount is only equal to half the salary he received from me, and...he was a subscriber to the native fund[4].

This Native Fund was a form of provident fund that was established at Fort St. George in 1807, and open to all Government servants born in the country. All Lambton's sub-assistants were subscribers, the subscription being about Rs. 3 a month.

LASCARS & FOLLOWERS

We have given particulars of the followers allowed in Rennell's time [I, 289] and of the provision made for them in the Surveyors' allowances [I, 276–7]. The following establishments were allowed to surveyors on the Mysore survey [330], and paid in addition to salary ;

To Mackenzie's headquarters ;

2 Peons	per month	Pag.	5	06	00
2 Hircarrahs	,,	,,	5	06	00
1 Tindal & 8 Lascars, with batta, as allowed on the Nizam's Survey...	,,	,,	27	07	40
Addition for Mysore					
1 Tindal & 12 lascars ...	,,	,,	36	45	00
1 Packally	,,	,,	4	20	72
Artificers					
1 Carpenter, with Batta	,,	,,	4	12	00
1 Smith	,,	,,	4	12	00
1 Bellows Boy & 1 Hammerman	,,	,,	5	06	00
[Mather was allowed[5]]					
6 Lascars, with Batta ...	,,	,,	17	12	00
1 Hircarrah	,,	,,	2	34	00
1 Puckally	,,	,,	4	20	72

Bearers for carriage of tents were provided in addition. Sub-assistants were allowed 3 lascars each for carrying instruments, "but when 2...are employed together 4 lascars are supposed sufficient"[6]. Batta was calculated at the rate of 2 *fanams* a day for a tindal, and $1\frac{1}{2}$ for a lascar [330 n.1].

[1] DDn. 156 (307), 28–11–17. [2] DDn. 83, 27–1–10. [3] to Dr. John Duncan, ib. 16–2–10. [4] MMC. 26–4–11. [5] DDn. 41 & MMC. 6–11–1799. [6] DDn. 64 (24), 21–12–03.

The Governor noted that, when the students of the Military Institution took the field,

One Tindal and Eight Lascars are allowed by the Regulations to every Surveyor, but Lieutenant Troyer has informed me that in the present case a less number will be sufficient, and I accordingly propose that Six lascars be allowed to each Gentleman of both classes of the Institution about to be employed on Survey[1].

This number was not sufficient for Blair on the survey of Travancore ;

I have as Engineer with the Travancore Detachment 1 Tindal and 8 lascars, of which when I have allotted two to the measuring chain, two to the perambulator, two to my Theodolite (for I have found one to be insufficient), one to carry my fieldbook, and one my sextant and glasses, you will perceive that I shall not have one man left to carry poles, pins, nor any one to detach with flags, or carry the umberella (*sic*) that is to keep the glare and heat of the sun from the Theodolite.

The flags alone require a great many people in this country, when they must be conveyed in boats whenever you require them, and of course cannot be shifted about quickly. I consider therefore 1 Tindal and 12 lascars in addition necessary[2].

The 1807 regulations for the assistant revenue surveyors laid down the number of lascars to be provided [349], and their pay ;

The pay and batta of lascars being 2 Ps. 34 fs., the Collector or Surveyor is allowed to draw at that rate agreable to the number of lascars above specified. ...

Collectors are not on any pretence to allow their surveyors a greater number of lascars than has been stated. ...

They will not permit surveyors who have obtained leave of absence to take their surveying lascars along with them, as their allowances are deemed fully adequate to their travelling charges, and that surveying lascars are understood to be allowed them when actually employed in surveying only[3].

Garling worked out carefully the numbers of lascars necessary for the Sonda survey ;

The principal series of triangles cannot be uninterruptedly prosecuted with an establishment less than 24 lascars.

The average number of stations occupied at the same time by flags must be considered to be six ; to keep each of these flags in their proper situation requires two people to look after it, for one man will not by himself ascend a high mountain & pass the dangerous jungles, nor can the duty be performed by less than two people ; the average number for keeping the flags properly erect on the stations is therefore 12.

For each station when visited 3 new flags may be sent out, with each of which 3 lascars must be sent ; a less number cannot carry the flag, or place it ; 9 lascars. Two or three lascars are required for care of the instrument & its tent, and for communication. Total 24. ...

Exposed to constant fatigue, and that generally in situations where the climate is bad, a proportion of the lascars is always sick. In the Pollams[4], in 1810, with an establishment of 30 lascars, 18 were fit for duty ; at Goa, in the beginning of 1811, one third of the establishment were sick.

ESCORTS

Escorts were no longer a matter of necessity for all surveyors as they had been during the 18th century even within the Company's territories [I, 300–1]. They were still required for surveyors on active service, as for Sackville and Morrieson in Bundelkhand [48–51], and White beyond the Delhi frontiers [60–4].

When Colebrooke went up country in 1807 he was given a strong escort from Cawnpore ;

The Surveyor General, being about entering on a Survey of the Northern Frontier, is to be furnished with a Permanent Escort from the Native Troops at Cawnpore, to be composed of a Jemadar, 3 Havildars, 2 Naiks, a Drum & Fife, and 50 Sepoys, under the command of Lieut. Webb, ... ordered for that purpose to repair immediately to Cawnpore [31][5].

To reinforce this escort on the northern borders he obtained the services of

[1] MMC, 11–11–06. [2] From Blair, 30–6–05 ; MMC. 16–7–05. [3] DDn. 133 (302) 17–1–07. [4] Hill areas on borders Cuddappah–Nellore–Chittoor [127, 246, 370]. [5] BGO. 9–11–07.

Captain Hearsey "attended by four Hindoostanee Sowars" [74] and the infantry escort was increased to a full company ;

Having learned at Lucknow...that there are two notorious rebels...on the Nawab's Frontier in the vicinity of Mohomdy[1], and near to whose lurking places my Route will lay, I have applied...for a re-inforcement of an Officer and a Company to escort me to the place where I shall pass the Nawaub's Boundary. ...

My Original escort Commanded by Lieut. Webb being, by the small parties sent with my native assistants [31, 353], reduced to 40 men, I thought this a necessary precaution to avoid being attacked and probably plundered by the Rebels in question, as I understand that they have occasionally contended with a much larger force than my party consists of.

To obviate the necessity of any future applications of this sort, ... it would be very desirable that a General Order should be issued, either to augment my escort to a complete Company, or to furnish me with such occasional re-inforcements from the several Stations I shall pass[2].

On the Mysore survey Mackenzie prided himself that he and his assistants had maintained such excellent relations with the inhabitants, that protection had been rarely required[3], but Lambton always had a guard for his precious instruments, and in 1802 obtained sanction to maintain a permanent escort of his own ;

As I have found it necessary to have a small guard of sepoys to move along with me for the protection of my Instruments, and finding it most convenient to have the same party constantly attached to me, I am induced to address the Honorable Governor in Council for permission to entertain one Havildar, one Naiq, and Twelve Sepoys, to be furnished with arms and accoutrements from the Publick stores, and to be cloathed and payed the same as regular Sepoys [334][4].

Further detachments were added for Warren and Kater, bringing the strength, in October 1803, to 1 havildar, 3 naiks, and 24 sepoys, at which it was maintained after the withdrawal of these two assistants.

CARE OF HEALTH

Though many parts of Bengal and the Upper Provinces were extremely unhealthy at certain times of the year, as witness the disastrous attack of fever that overwhelmed Smyth's party in Chota Nāgpur [46], yet it is from the south that we hear most about the crippling effects of climate and fevers.

Mackenzie himself was a constant martyr to ill-health, and he was all the more considerate to others. On the formation of the Mysore survey he welcomed the appointment of Dr. Heyne as botanist and assistant surgeon [113] and was most disappointed to find that Heyne was far more interested in his botany and other scientific pursuits than he was in the health of the establishment. The climate of the country "above the Ghauts" had a particularly evil reputation, whilst "the coast" was considered a comparative health resort, and a sea voyage the complete cure.

Both Warren and Mather were frequently on the sick list after moving up to Mysore ; in fact Mather's start had been delayed for several weeks owing to his "troublesome complaint", which seems to have been a form of rheumatism, and Mackenzie writes to him in June ;

I was much gratified by finding your health was so far restored as to enable you to begin your survey with the effect you mention. I leave the order of going on with the districts entirely to yourself, the rather because your state of health requires your paying some attention to the nature of the country, and during the rainy and cold season I would recommend by all means your avoiding the jungles, as you can manage them better in the hot season[5].

The rains of the following month, however, drove Mather down to the coast.

To Warren Mackenzie writes ;

I am much concerned at the prospect of your Complaint returning, which I know too well requires precaution to a person once affected by it, and I think you do perfectly right to... retire to Bangalore for your health, as the best means to get rid of a troublesome complaint that weakens the constitution so much[6].

[1] Muhamdi, 63 A/1. [2] MMC. 18–1–08 (78) [3] A guard had been necessary whilst Dhoondia Waugh was still about [94–5, 367]. [4] DDn. 63 (77), 8–7–02. [5] DDn. 66, 17–6–1800. [6] ib. 18–11 & 27–12–1800.

In December and January Mackenzie's own party was overwhelmed by fever near Sandūr on the north-west frontier [97–8];

I have been impeded by several circumstances, the most mortifying of which was Mr. Arthur's being taken ill of a fever the next day after we parted, and I was on the point of returning 46 miles to take measures for conveying him to Chittledroog, when I got notice of his being better ; he is not however able yet to do duty, and this accident makes it prudent for us not to separate far again till the season is more advanced, as in the case of being taken ill we can assist each other ; I have had a slight ague, and several of our natives, but the worst of it seems past ; we have lost none ; all our Sepoys are well, and we have now a very few convalescents[1].

Close notes in reply that,

since the termination of the monsoon, fevers have been general all over the upper country, and as they have been rather of a malignant kind in some districts, it gives me extreme pleasure to find that your party, after having been so sickly, have recovered so soon[2].

However the fevers came on again, and continued at intervals till the end of March, and Mackenzie had to ask for medical help from the garrison at Gooty, Dr. Heyne being away botanizing at Bangalore. He writes to Mather ;

I was concerned to see your survey was likely to undergo a temporary suspension from the illness of your party ; it is the same thro' all the country, & cannot be helped. We are here suffering very severely from it, but the sickness is not mortal, and by the use of emetics and bark may be surmounted[3].

He writes to General Campbell, who had sent a doctor from Gooty ;

I can never sufficiently acknowledge your kindness in sending Mr. Souter, whose skill and manner of acting gives me every confidence, and relieves me from the unpleasant task of attending to the sick, a business I did not well understand. He joined us on 23rd in 4 days from Ghooty, and we came there yesterday. I wished by halting a day to give him an opportunity of seeing the cases which are mostly Agues, and unfortunately he has no bark, and my little stock is nearly exhausted. If any can be still got among your medical stores it will be a valuable relief, and may be sent by post to Bellary. ... We have still about 20 sick out of 200 nearly of our whole party. ...

For myself I am not very well, and still have some symptons of the ague hanging on me ; I am however awaiting to know of the bearers being posted that I may proceed towards you ; the change of air will undoubtedly be of service[4].

The "bark" here referred to was of course the bark of the *cinchona*, a plant that comes from the western mountains of South America. It was known as a febrifuge as early as the 17th century, and, having been brought to Europe by Jesuit missionaries, was generally known as "Jesuit's Bark". We find an advertisement in the *Calcutta Gazette* of 3rd March 1785 ; "Bark. Fresh Jesuit's Bark, in the Quill ; just imported from the Brazils. On Sale". The Dutch succeeded in growing it in Java in 1854, and five years later its cultivation was introduced into India and Ceylon[5]. It is now well known as "Quinine".

Mackenzie now wrote to Heyne suggesting his return ;

We have had the assistance of a Surgeon from Camp lately but, as he necessarily returns, the natives of our party, who have suffered in common with others in this general sickness in the upper country, stand much in need of medicines, and some proper person able to give them. We have thrice got medicines from Chittledroog, and also from Camp[6].

To Mather he writes ;

It is with much concern that I understand...that your rheumatic complaints and the sickness among your people have again returned so severely. In such a case there is no other remedy than to retire to any place where medical aid can be got.

Tho' it can be of little comfort to you, yet it is but justice to us, you should not suppose that in this quarter we have been better off, as the whole party was nearly laid up, having 30 sick at once ; Mr. Arthur obliged to go to the coast, and I have only remained myself against the opinions of the surgeons. ...

Health is a valuable blessing too often sacrificed in our Indian pursuits ; but you...are not the only person whose vocations call them into situations detrimental to health, and that particularly every military person in the Company's service has no choice where their duty calls them[7] [*sic*].

[1] DDn. 41, 24–12–1800. [2] DDn. 68 (248), 18–1–01. [3] DDn. 41, 18–1–01. [4] DDn. 66, 12 & 26–1–01.
[5] The capture of Java by the Japanese in 1942 left India and the allied forces desperately short of quinine, and stimulated the development of other cures. [6] DDn. 41, 5–2–01. [7] DDn. 66, 25–4–01.

Heyne did not rejoin till August, at the same time as Arthur, who went down with fever again almost at once, Mackenzie writing ;

Our Progress in this Journey, whence the Country bordering Bednore was surveyed, was again repeatedly embrrassed by sickness first appearing among the Western Hills, when exposed to the influence of the Malabar Monsoon ; & tho' I was rejoined about this time at Heroor by Dr. Heyne, the Surgeon (August 2nd), & Mr. Arthur, the illness of the latter & the other Assistants obliged me to relinquish the attempt (Sept. 7th) & go into Serah, where, leaving the Sick & Convalescent, I made arrangements for effectually closing the remaining part of the N.E. Boundary[1].

He writes to Arthur, who remained poorly for several months ;

I beg by all means (if you are better as I hope you will be on receipt of this) to leave off doing anything in the mapping or writing way, as any labour or intense application of the mind...is detrimental in such cases. Such has been recommended always to me, and I may venture to say so much without interfering with the province of the medical line.

P.S. I entreat you will give over any idea of doing anything to the maps. Enough is done till I return myself. I have been obliged to employ Burke's hand [355 n.7] on account of my fatigue and sight. ...

I beg you will write me whether Dr. Heyne's illness is of such a nature as to render it proper to send for a surgeon for you all. On this point I hope you will write me soon, and whether I should send you any bark. ...

P.S. I would recommend you to keep up your spirits, as the surest support is in your own mind ; anxiety ought not to prey on your mind and is hurtful.

Get from my butler any things you may be in want of. I have all the tea along with me ; let me know if you want any[2].

Early in 1802 Arthur again took leave to the Coast, followed by a sea voyage to Penang, and Mackenzie himself withdrew to Madras, whence he wrote to Mather ;

It is difficult for me to describe the embrrassment I labor under for want of writers and draftsmen [278]. Poor Burke, contrary to my advice, having been ill of a disorder to which youthful imprudence has exposed him, has for near 20 days been absent from me, and I understand is not very well. I have in vain urged him to come out to my house, and have spoke to a doctor about him, but he has not gone near him. I am anxious to get him near me again for fear his health should be ruined[3].

Again from Madras in January 1804 ;

I am glad you are so far recovered. At Madras many have of late been subject to rheumatic complaints (of which I have not been free) from the close hot weather following the very heavy rains. I hope the young men will preserve their health in the dry season ; change of air is always useful, and youth is on their side. A surgeon is appointed who accompanies me up, but I shall not be able to go for some time yet [114][4].

In spite of his constant ill-health Arthur took a keen interest in life, and has left a vivid account of his experiences [208]. He records in his journal ;

The fever, with which I was seized some days ago, continuing to return every three or four days, prevented me almost from doing anything...at the Papers of the Survey, and the greatest part of my people were taken ill of the fever...which is of a very malignant kind ; the patient's skin and eyes after the first day becomes quite yellow and, when it proves fatal, he generally dies on the 4th day ; three of my followers, two women and a man fell victims to it. Mercury is the only medicine that succeeds in curing it[5].

Dr. Leyden who now took Heyne's place went sick himself very soon after reaching Mysore, and on moving westwards to the Ghāts, Mackenzie appealed for further aid ;

I understand fevers are prevalent at this time of the year and, as we have had no medical Assistance...for near 13 months past from the absence of the surgeon on account of bad health, I hope some measures will be taken, ... having lost 3 followers by sickness, and a sepoy from a fall, since April last, and being now to remove to a considerable distance from Chittledroog, whither I have hitherto sent the more dangerous cases and received every due attention[6].

He wrote two weeks later to Mather ;

I have received information lately...that the Surgeon at Bednore will have orders to give Medical Assistance to the Surveying parties ; you will of course apply there if any is necessary,

[1] DDn. 42, 12–7–03 (25). [2] DDn. 66, 28–10 & 1–11–01. [3] ib. 18–5–02. [4] ib. 23–1–04. [5] Journal, 4th to 15th Jan. 1805 ; GBO. Lib. A b. 85. [6] MPC. 13–12–05.

tho' I am happy meantime to find your party continue well. It is however proper to have every precaution taken.

I have lately got a supply of medicines from Seringapatam ; if you want any they can be sent. We are well here today, but of late we had two or three sick, & Ward has been ailing of late, but is now well. Bye the bye, he appears to me to want some good warm coat for the approaching cold weather, but he tells me you expect some cloathing for him[1].

The following year, after two seasons on the Western Ghāts and in South Kanara, Mather's health broke down completely and he had to resign [109].

Curiously enough, though Kater's health broke down after two years on the trigonometrical survey, we hear very little from Lambton himself about sickness. This is unlikely to have been due to any particular immunity, or to the work being of a more healthy nature, but possibly to Lambton's studied avoidance of the subject in official correspondence. We have far more of Mackenzie's day-to-day letters preserved, and consequently hear more of his troubles.

The revenue surveyors on district surveys suffered from fever and sickness continually, and Keyes writes from Coimbatore in April 1812 ;

On the 3rd of last month I...repaired to Danaikencota with the best part of my followers very ill with the bilious fever, ... & within the interval of my having staid at Danaikencota for the purpose of having the men cured, which was till five days ago, both Sub-Assistant McMahon and myself had been afflicted with the same disease for a few days. ... Nothing was done during the last month [148][2].

We find the following delightful letter from one of the Collectors in the Ceded Districts[3], whom Morison had asked to help with medicines ;

Immediately on receiving your letter I sent off the list of medicines enclosed in it to Mr. P., and as I was then writing to Mr. Swinton[4] I requested him to say to you that Mr. Dunigan should have as much medicine as he wanted.

I now find, however, that in sending that message I reckoned without mine host, or at least without my Doctor, for Mr. P. writes me that his stores will not admit of his supplying all Mr. Dunigan's physical wants, and he accordingly has sent him only as follows, viz. ; 3 dozen Calomel pills of 1½ grains—and 2 ounces of Bark (N.B., about equal to none at all)—½ an ounce of Jalap—and Drachm of Ipecacuanha, so that the most essential, the Salts, and the less essential, the Rhubarb, are wanting.

I think you had better send up a parcel containing a quantity of each to the party, for our Doctor parts with his medicine with but an indifferent grace. Not from any ill will, or reluctance to oblige, but for this good and substantial reason, that he cannot get them replaced. Doctor's indents are liable to be cut down as well as other people's ; they, like other folks, have their grievances, and when grieved they growl. From this I draw a wholesome consolation that though poor Collectors have the greatest share, yet others have also some portion of his misery. How are Commissaries off in this way[5] ?

Adieu, my Dear Sir, do not fear giving me trouble ; I am paid for it, and am happy when I can make myself useful.

Tungatoor.
18th May 1812.

sd. Charles Robert Ross[6],
Collector.

Johnson has left an interesting note on the fevers of Malabar [I, 131] ;

Regarding Diseases of the Malabar Woods. ... Long experience & continued suffering enable me to describe my own feelings. ...

The Forests of Malabar are extremely unhealthful, regularly producing fever and Ague, and more particularly from the latter end of the rains, when vegetation had been forced to its utmost height, to the time of burning the grass, or from September to January. ...

To wear flannel next the skin and on the feet, more particularly whilst asleep ; to lie high from the ground, and keep a fire in the house or tent during the night ; not to walk out while the grass is wet with dew ; to smoke tobacco while the air remains damp[7], and to take regularly as much exercise as the...strength will, without feeling fatigue, admit of.

The worst complaint attendant on this fever and ague is an increase and duration[8] of the spleen, which remains enlarged for some years after the fever has left the patient. Many remedies have been tried to remove it, and Mercury given with but little success.

[1] DDn. 43 (141), 16–12–05. [2] DDn. 127 (226), 1–4–12. [3] ib. (265). [4] Not identified. [5] Morison being Commissary General. [6] Son of Patrick Ross (1740–1804) Mad. Engrs. [I, 382] ; bapt. Madras, 27–3–1783 ; d. Masulipatam, 26–11–16. [7] All excellent precautions against mosquitos ! ! [8] hardening.

From experience I assert that every remedy that tends to weaken the powers of digestion equally tends to increase the spleen, and nothing but keeping the body bare, taking continued and even fatiguing exercise, will effect a cure ; perhaps warm bathing might decrease the spleen, but, if great care is not taken, one cold caught will increase it again.

He recommends opium, as taken by the local people, but "Nothing appears to me equal to a moderate quantity of the best wine, and a free use of spices"[1].

Garling found Sonda, or North Kanara, most unhealthy [158–9] ; reporting

the continued indisposition of near half the Establishment. It has been necessary to send the Assistant R. Long within reach of medical assistance. ... The season during which Field operations can be continued will close with the present month, when it is intended to remove the whole Establishment to Onore[2], there to take up Quarters during the monsoon. The proximity of Onore to that part of Sonda in which the survey will have to be resumed has made me confident of your not objecting to this arrangement, while its conveniences and salubrity make it preferable to any part of Soonda[3].

Williams had a doctor attached to the revenue survey of Broach ;

Mr Assistant Surgeon Kemball's exertions in communicating the benefit of vaccination to the Purgunna and to many villages of the adjoining districts have been attended with complete success ; ... and it may, I imagine, now be safely stated that every individual in the Baroche Purgunna who had not had the small pox has been vaccinated, and rescued from the dangers of that disorder.

A most satisfactory proof of the efficiency of what had been done was afforded by the appearance of the small pox 4 or 5 months ago on the border of the Purgunna ; and in some of our own villages near it which have not been visited by Mr. Kemball it committed very melancholy ravages, whilst the vaccinated villages remained perfectly free from the infection, and formed a distinct and effectual barrier to the progress of the small pox[4].

MEN & MANNERS—UPPER INDIA

Occasional references have been made to opposition encountered by surveyors but, considering how far afield they carried their surveys, even during the actual course of military operations, it is really surprising that there were so few cases of serious obstruction. On the other hand, thefts of instruments and cash by casual thieves or wayside prowlers were not infrequent [58, 223, 225].

Reference has been made to White's adventures in the Sikh country east of the Sutlej in May 1809 [63]. Though he held passports issued by Ranjīt Singh, and was following a route authorised by the political agent, the villagers ordered him back with armed force, and thrashed his *chobdar*, a servant of Ranjīt Singh. Orders were then issued both by the Commander-in-Chief and by the Governor General that White was not to survey the territory of any of the Sikh chiefs along the left bank of the Sutlej, and Ranjīt Singh sent the politest apologies.

Seven months later he had another, even more unpleasant, encounter east of Bhatinda[5] in Patiāla territory, in which several of his party were killed and much baggage looted [64] ;

I arrived at Batinda on the 9th [December 1809]. ... On the 14th I reached the desert, but conceiving it imprudent to cross it or turn to the north, which would have immediately led me into Runjeet's country, I resolved on tracing the boundary of the desert in a south-easterly direction towards Batneer[6] and Futtehabad[7], and with this intention proceeded as far as Buktoo where, having satisfied myself as to the general northern limits of the desert from Hissar to Pak Puttun[8] and Buhawulpoor, and, thinking it inadvisable to venture into the Bhattee country, I took the direction of Mansali[9], a fort of considerable note, belonging to Sahib Singh [Rāja of Patiala].

As Bajee Sing, the person deputed by the Rajah to attend me, frequently assured me in the most decided manner there was nothing to apprehend, I did not thing myself justified in relinquishing an important point in the survey on the chance information of a few villagers.

On the 17th I left Buktoo[10], with the intention of encamping at Tulwundee, a small town belonging to the Rajah, ... but on my approaching the place, which is surrounded by *jungul*,

[1] Bo PC. 13–9–05. [2] Honāvar, 48 J/7 [I, 25]. [3] MPC. 21–6–14. [4] Bo RC. 28–7–13. [5] 100 m. S. of Lahore. [6] now Hanumangarh, 44 K/6. [7] Fatahābād, 40 O/6. [8] Pakpattan, 44 F/7. [9] Mansa, 44 O/5, 35 m. S. of Bhatinda. [10] Kot Bakhtu, 44 J/16, 12 m. S. of Bhatinda ; 25 m. SW. of. Chaoke.

several shots were fired at me, and I immediately thought it advisable to take the direction of Batinda, encamping that day at the village of Joudpoor, five *kos* from Tulwundee[1]. I, having however during my survey of the N.W. frontier been frequently fired upon, ... began to think but lightly of this affair, and the more so as Bajee Sing, when particularly questioned, still persisted...that I might proceed through the country in safety. ...

On the morning of the 18th, ... I was informed about 250 people had collected...with the design of attacking me. I immediately turned off into the *jungul*, relinquishing all thoughts of proceeding to Mansah. ... I...encamped this day at Chaoki[2], ... but before the tent was pitched an alarm of horse was given, and in a few minutes about a hundred had made their appearance. Well knowing this body would soon be greatly increased, ... I thought of...procuring safety in a village which I knew to belong to a Chieftain friendly inclined to our Government. Having therefore secured the most valuable part of my property, I commenced my march, leaving my tents and a number of things on the ground. ...

The horsemen, being joined by about sixty foot, ... armed chiefly with spears and bows and arrows, began the attack, but at so respectful a distance that I would not harrass my men by returning a useless fire which would have greatly retarded the march.

By the time I had gone one *kos* the enemy had augmented to about 500 men...from different villages, and began to press on me so close as to force me to commence firing ; but although the enemy were individually brave, particularly the foot, who frequently came so near as to spear the *sipahees*, yet I was enabled to proceed two *kos* further, without allowing them to make any serious impression on us. ...

As the *sipahees* were beginning to break and waver through fatigue, having marched fifteen *kos* through a woody country and fought upwards of two hours, I was forced to sacrifice the baggage (a string of sixteen camels, several of which were severely wounded) and order it to be relinquished, and endeavoured to encourage the men with hopes of relief at Pukoke[3], from which we were but one *kos* distant. ...

On our arrival however at this village, ... we were greatly disappointed to find the inhabitants join the enemy, and, with this addition to their force, I do not hesitate to say that in my opinion we had to oppose one thousand men. ... My *sipahees* now began to fall fast, and any attempt to proceed further in a country covered with *jungul* was evidently absurd. The only chance of saving the party was that of storming the village and procuring shelter amongst the houses ; this plan was accordingly adopted. ...

I immediately dispatched two *hurkarahs* to Colonel Ochterlony soliciting to be reinforced. ... Early next morning Run Sing, the nephew of Juswant Sing, arrived...to my relief. Tranquility was immediately restored in the village.

Meeting further assistance on the way, White reached Ludhiāna on the 22nd.

The loss on our side is 3 *sipahees* killed, 11 wounded, 3 servants killed, 3 servants wounded, belonging to Captain Skinner's[4] Irregular Corps ; wounded, 2 horses, Lieutenant White's killed, 4 horses belonging to Captain Skinner wounded, 2 of which were left at Pukoke as unfit for further service. The whole baggage excepting the ammunition and the Soobidar's property lost. ...

I had requested Government that during my survey I might be accompanied by respectable Vackeels from the different Chieftains through whose territory I should proceed. ... The person sent by the Rajah to accompany me was...not near so respectable as a common *hurkarah*. He even the first day begged of my servants *one anna* for his subsistence (I immediately ordered him ten rupees). ...

The loss of baggage can be easily repaired, but that of my books, papers, maps, and a series of information which I had collected during a four years' survey, the great part of which, in the hopes of its being rendered more perfect, had not been communicated to Government, is a loss of a very serious nature, and the more so as...I am fearful no other survey in this part of the country can any longer be considered as advisable[5].

He claimed compensation for the loss of tents, camels, horses, cash, clothes, camp furniture, and surveying instruments to the value of over 8,000 rupees. Government sanctioned the full amount claimed for the books and instruments ; compensation for the horses at regulation rate, and "for the remainder...according to the rates allowed for an officer of his Rank, ... plus 3 months full Batta"[6].

Efforts to bring the leader of the gang to justice were unavailing, though his identity was well known :

[1] Jodhpur Pakkar, 44 N/4, 10 m. S. of Chok Bhakhtu ; Talwandi Aklia, 44 O/5 ; Talwandi Sabo, 44 O/1. [2] Chaoke, 44 N/8, 25 m. E. of Bhatinda. [3] Pakkho, 44 N/8 ; 5 m. NE. of Chaoke. [4] James Skinner (1778–1841); Comdt. Skinner's Horse from 1803 *DNB.*; *DIB.* [5] *Ludhiana Rec.* (149–51). [6] BMC. 6–3–10 (10).

It appears that the head of the gang of robbers who attacked and plundered Lieutenant White was Phola Sing, an Akaulee, who is a subject of Runjeet Sing, and joined the troops of that Chief...when he found that the arrival of Run Sing prevented him from accomplishing his purpose, which seems to have been not merely to plunder, but to destroy, the party[1].

As the report of Phola Sing, the head of the gang, ... having found refuge in Runjeet Sing's camp proved to be unfounded, I...forebore making an application on the subject to that Chief.

Having heard that he had taken refuge in Dumdumah[2], his usuel place of residence, which belongs to Rajah Sahib Sing of Putteealah, and is about 80 miles to the southwest ward of that town, ... troops were accordingly embodied and detached to Dumdumah [by the local chief]. ...

He is himself [Phola Sing] an Ukaulee, or Sikh priest, and it is well known that people of that description, whatever their moral character may be, are held in veneration, and that their persons are considered as sacred and inviolable. ... The event was such as was to be expected. The place was taken, but the murderer, being a priest, was suffered to escape. ...

On quitting Dumdumah, Phola Sing fled to Umritsar, where he still continues, and...there is little prospect of Runjeet Sing's being induced to consent to the seizure of his person.

Phola Singh was found to have been "both the instigator and the leader of the murderous attack made upon the British mission [under Metcalfe] when camped at Umritsar in the month of February in 1809" [62][3].

We have already noticed the adventures that Sackville had during his surveys in Bundelkhand [49], but his work down in Orissa was peaceful ;

The Orea dialect or language...is so totally different from the Bengalee or Hindustanee that our servants are as little able to understand them as ourselves. We have therefore been under the necessity of picking up a few words most necessary in our general enquiries, and hope in the course of a short time to become better acquainted with them[4].

Morrieson met with occasional trouble in Bundelkhand [49]. He tells of one incident the Sundarbans, well known as a haunt of dacoits ;

Marching from Boodooria[5] on the bank of the Issamuttee, ... my people were attacked, and Several of them considerably hurt, by a numerous body of armed men, headed by the Jemedar. ... This attack seems to have been entirely unprovoked on the part of My people, and I am sorry to say that, in addition to the maltreatment, a few articles, tho' of small value in themselves, yet of consequence to the people to whom they belonged, have been detained.

On my arrival on my Ground, and hearing the complaints, I despatched a Naik and Eight sepoys, being all I could spare at the time, with a message to the Jemedar, importing that I was astonished at his behaviour, and begged that the articles stolen might be returned, as also a person might be sent to make some apology for the outrage.

The Naik reports that on approaching the Village armed people, to the amount of 5 or 600, ... retreated into their huts, and that a large party with the Jemedar secured themselves in a Pukka house in the centre of the Village. The Naik, having delivered my message, was answered by a torrent of abuse, and was desired to tell his master that, until summoned by the Judge, they would not move from their village, and further accused my people of having plundered their village and carried off Several women, which assertion I can positively deny[6].

In forwarding this report, the Surveyor General suggests

that these People have some interested motives to induce them to endeavour by violence to prevent their Lands from being surveyed ; probably some Tract of Country has been brought under cultivation which they are desirous to conceal[7].

When sending Stephen to survey Benares district the Surveyor General warned him to be discreet ;

The country you will pass through is inhabited by a variety of casts of Hindoos, particularly the singers, a very turbulent race of men. It will be incumbent on you not only to avoid giving them offence yourself, but to be careful your servants do not in even the smallest trifle give rise to complaint.

They will probably object to their lands being measured, and it will be wise to conciliate their chiefs by assurances that the survey is made for general purposes, not to enquire into the Tenures of individuals. Probably a little attention will produce you every attention, the contrary may occasion bloodshed, and a number of difficulties being thrown in your way. During the cold season I would recommend every exertion in your power being made whilst the weather is mild and the country dry[8].

[1] From Resdt. at Delhi, 28–12–09 ; *Ludhiana Rec.* (157). [2] Kot Dharmun, 44 O/5 ? [3] ib. (211), 7–5–10. [4] DDn. 82 (138), 1–3–10. [5] Baduria, 79 8/14. [6] Report by Morrieson ; BMC. 21–5–11 (22). [7] DDn. 126 (94), 19–5–11. [8] ib. (117), 14–12–11.

He advised Blake who was going up to Gorakhpur to

use the greatest mildness towards the natives, preventing your servants & followers from plundering or in any way illtreating them ; the advantages of such conduct are obvious[1].

Accounts have already been given of Raper's difficulties along the frontiers of Chota Nāgpur [46], Pickersgill's adventures with the Nepalese [39–40], and Hodgson's dealings with the Gurkha commander in the Dūn [83].

MYSORE

Throughout his seven years in charge of the Mysore survey Mackenzie maintained the most cordial relations with the Resident and the State officers, and took vigorous steps to remedy any friction or unpleasantness arising between his assistants and local officials ; regular arrangements were established for local guides and peons, and sepoy guards were furnished from the nearest military stations whenever these were necessary [94, 98].

Trouble occasionally arose in out-of-the-way parts, and more especially when Mackenzie passed over the northern border into the unsettled Ceded Districts where Munro had just assumed charge [98] ;

My Moonshie...writes me a most lamentable story that his horse, which the poor man has used now since 1790, has been actually claimed and taken from him at Adony by a Ryut, who says it has been missing only 10 weeks. For Heaven's sake, Munro, do not suffer such a flagrant imposition to pass unnoticed.

The munshie was sent by me forward to Adony[2] ; ... I want him much with me ; ... I expect he will not be detained nor his property taken from him ; he tells me it is the same horse he carried from our party, and our people can identify the horse ; at any rate I will be contented that the horse or its value will be restored if the proof is made good, but I hope the man's character will not be arraigned without some enquiry. The poor fellow exclaims "What justice is this ? to have my horse taken from me and be accused of stealing ; and under British protection". I expect you will have many of these stratagems played off when you get near the Mulmulla Hills[3]. ...

I enclose you all I can get here of the Moonshie's horse ; unless he has changed it since 10th December...there can be little doubt in the case. ... It is probable they may have lost a horse, but it is very unlikely that this man should in this short space steal it, or buy it from suspicious persons ; as, added to his own character, I have always discouraged promiscuous trafficking among our party[4].

Munro does not appear to have been convinced, even by a last appeal ;

I send two seapoys, two lascars, and a relation of my Moonshie's to be examined regarding the horse he had with us for some time, and which he tells me was delivered over to the claimant without even examining the three witnesses he had on the spot. I request you will interpose your authority to have these men examined, and evidence not suppressed. ... As a servant of mine, travelling in my employment, I should expect of any of my acquaintance interposition against ill usage[5].

Two months later there was trouble with the headman of Rayadrug[6], also in Bellary District, and Mackenzie writes to General Campbell ;

I cannot express to you the insolence and even cruelty of the Amuldar and his people here ; the deliberate disrespect and inattention to the Army in general, inculcated by some of Major Munro's people from the coast, deserve notice, in my opinion. For my own part I am determined to relinquish the survey for ever rather than to submit to further inconveniences from these people.

In Mr. Arthur's situation [98], I could get only 4 coolies and 2 guides (out of three wanted), if it was to save him from death ; and only advancing the hire. The insolence of the language used by the Amuldar and his underlings I will not attempt to convey. ...

To prevent mistakes I sent a Havaldar to deliver another message that it might be transmitted to Major Munro ; their insolence to the Havaldar and to all concerned I am at a loss to describe. Hard ! that when we are sacrificing our constitution for the service we should be subject to such destructive delays from the refuse of mankind. ...

[1] ib. (146), 25–4–12. [2] Adoni, 57 E/6. [3] DDn. 66, 28–12–1800. [4] ib., 4–1–01. [5] ib., 12–1–01. [6] 57 B/14.

I suppose you have heard of the very handsome charge brought against me by Major Munro's Amuldar of Raidroog, of putting the Sub-Amuldar (whom I have never seen) in the sun for a whole day, and making extraordinary demands (equally absurd and equally false) alledged to be customary with me in Mysore. Although I treat this with the contempt it desrves, I am not the less surprised to find it countenanced by a person of Major Munro's reputed good sense[1].

Mackenzie was still bristling over this case several months later, when he warns Arthur that

it has become very common to send in complaints in Mysore against officers, and perhaps sometimes with reason. ... In fact, no blame can attach for listening to their complaints, but proper enquiry should be made, and no person should have blame even insinuated without proof. In two cases that occurred with Major Munro all evidence was avoided, and yet he presumes to reason on what never happened[2].

To Mather he writes ;

I would recommend to you by all means to conciliate the minds of the people you have to deal with, as the readiest way of forwarding your business, and in particular to keep a vigilant attention to prevent any injury to the natives, in person or property, by any of the followers or guards. This I am confident I need not to recommend to you, but several instances that occur in various parts of the country render it necessary to give this caution, to prevent any misconception of the general conduct of the survey[3].

It was found expedient to drop some of the statistical enquiries first proposed [103, 105], and Mackenzie writes to Mather ;

Your idea of Purniah's being hostile to the survey I do not find to be very just, as he seems very willing to support it, but in a certain light you will recollect that the management of the Rajah's revenues is on a very different footing to the Company's, and that there are prejudices in a Hindoo management which it is not easy to overcome ; nor indeed is it our business, as we must confine ourselves to what is permitted.

Anything that looks like going into investigations of revenue or population will not be relished, and you may recollect my observing that I could never get any account of the latter, except by houses[4].

The Resident writes later ;

The Dewan has expressed a desire that all further enquiries respecting the number of Ryots and inhabitants of either sex in Mysore may be put a stop to, as such an enquiry tends to alarm the health of the people, from their ignorance of the nature of this research. I have therefore to request you will have the goodness to...refrain from requiring a list or account of the number, ages, or other particulars respecting the inhabitants[5] [213].

Mackenzie reports later that

enquiries into the Revenue were altogether avoided, as tending to create an uneasiness, and possible counteraction that would have possibly retarded the progress of the other branches, without deriving sufficient advantages[6].

In another report he writes ;

The same conciliatory method was recommended to be observed...that I had found so productive of the best effects in my own investigations. ... I...notice the full and cordial support afforded to the several Branches of the survey by the Heads of the Civil and Military Authority in Mysore. In the whole of its progress a sufficient security was furnished in the most exposed situations by the Guards furnished by General Wellesley's order [94]. ...

The arrangements formed by Colonel Close at the beginning, and afterwards adhered to by the several gentlemen of the Residency, procured the means of every information and aid...by the Dewan's subordinate officers with a promptitude and exactness...that was new to me among natives, while it was extremely satisfactory in answering its object[7].

He pressed the value of his statistical and historical researches [93, 111] ;

At a moment when the attention of the Governments of India, and the Legislature in Europe, is turned to the amelioration of the state of the native subjects ; the means of conciliating their minds ; of exciting the habits of industry, and cultivating the arts of peace under the security and milder influence of fixed Rules, it is presumed that such investigations cannot be viewed with indifference[8].

As we have already told, Arthur was removed for the survey in 1805 on account of complaints made to the Resident [105, 107]. Mackenzie took these the more seriously as Arthur had been charged the year before with

[1] ib., 6–2–01. [2] ib., 18–6–01. [3] DDn. 41, 26–6–01. [4] DDn. 66, 28–12–01. [5] DDn. 68 (302), 25–8–03. [6] to Pte. Sec. to GG., DDn. 43, 1–5–04 (8). [7] DDn. 42, 13–7–03 (32). [8] ib. 1–10–03 (44).

paying insufficient Prices for Provisions and Labours—Not paying at all for carriage from village to village—Personal Violence to inhabitants—& their attendance unnecessarily & inconveniently required[1].

The English Gentleman employed on the survey, Mr. Arthur, having proceeded to Seringapatam to celebrate the Feast of Christmas, returned to the District on the 8th January, since when to the present date he has been daily collecting gold and silver earth, etc., and melting the earth brought from different quarters. ... The following is the list of such persons as are required to be stationed in attendance, viz.,

The Chittys of the Pettah ; dealers in Rice, Dall, and other articles of consumption for the bazaar—Chunani people for the purpose of manufacturing whatever charcoal may be required.

Pariah people to be ready to blow bellows with leather—Sadlers, Tanners...—Fishermen with fish.

Of the people called Toties & Tollaries, four persons ; Five other persons for other different purposes.

For the purpose of bringing in earth daily, from 10 to 20 persons as occasion may require must be ready to obey orders without the smallest delay.

Six cows must be brought from the villages, and kept in the Cusbah to furnish milk in the morning and evening[2].

In passing these complaints to Mackenzie, the Resident pointed out that he had already written that it was

inexpedient to entrust to Lieutenant Arthur the conduct of a separate survey involving circumstances of some delicacy. I now think proper to inform you that, upon inspection of the records, ... the greatest dissatisfaction has prevailed on his part, as well as on the part of the local officers of this Government ; the consequence has been the receipt of repeated complaints from those officers of the unauthorised demands made by Lieut. Arthur on the one hand, and on the other of complaints by Lieut. Arthur of the want of Assistance. ...

With the exception of Lieut. Arthur, every person attached to your Department has united with his labours the cordial concurrence and assistance of the officers of this Government. ... The singular exception of Lieut. Arthur constitutes alone a very powerful reason for distrusting either his means, or his inclination, to use a sufficient degree of prudence and conciliation. ...

It is accordingly my direction that you immediately recall Lieut. Arthur from the separate survey at present entrusted to him, and that he may be in future restrained to such duties only of the survey as can be executed under your immediate orders and inspection[3].

Arthur was ordered to dismiss his private servant who was considered primarily responsible, and to adhere strictly to the orders forbidding detailed enquiries into private statistics. The type of complaints he had himself been making may be gathered from his journal ;

This was the weekly market day called in Canarese a haut, and was well attended by merchants from the neighbouring towns ; coarse boiled rice was here selling at $8\frac{1}{2}$ seers per sultan fanam, although the rate furnished me by the Amuldar was only $6\frac{1}{4}$, and other things in the same proportion dearer than the rates among themselves, which proves the advantage the natives of this country will take over an European when they have the opportunity and, if he does not immediately comply with their demand, however exorbitant, they forward a complaint couched in all the craft of Indian malignancy, in which to them truth is by no means a necessary quality, and as it is difficult to investigate their authenticity, they are too often believed when positively without the least foundation[4].

Arthur's point of view appears little different from that expressed by Mackenzie himself when complaints were laid against his men and himself a few years earlier [366–7] ; but he now extended no sympathy to Arthur and, on receipt of a further report from the Resident, Arthur was discharged from the survey ;

I yesterday received a representation from the Dewan against Lieut. Arthur, who it appears so overloaded the coolies engaged to carry his baggage, as induced them to complain of the grievance. ... The Ryots employed as coolies...were made to carry a palanqueen heavily laden with various articles, which by their account would require ten men instead of four, the number employed[5].

After Arthur's departure, there is no record of further friction, and at the close of the survey in 1807 Mackenzie wrote to the Resident ;

[1] DDn. 43 (50), 13–4–04. [2] DDn. 68 (324), 15–1–04. [3] DDn. 68 (318), 24–1–04. [4] Journal, GBO. Lib. Ab. 85, 30–9–40. [5] DDn. 68 (353), 22–4–05.

In returning the Hircarrahs which have been attached to me by the Diwan...I consider it particularly incumbent to state the undeviating assistance...I have experienced...from all ranks of the public Officers and inhabitants since the survey commenced in 1800, with scarce an exception. ... Nor was our Personal security or that of our property less sedulously attended to in the more remote districts, Guards or Peons being...relieved from one district to another; and during the whole period, & while travelling in the wildest parts of the country, not one instance has occurred where the one or the other has been attempted to be violated[1].

LAMBTON'S SURVEY

Lambton and his officers were working under circumstances very different from those of the Mysore Survey. They were moving over the full extent of the peninsula, from one province or state to another, and had no chance of intimate co-operation with local officials; they were not concerned with local boundaries or statistics, but their major concern was the ready access to mountain tops, and ample provision of transport and supplies. There were occasional difficulties, such as crop up frequently in the later history of the Great Trigonometrical Survey.

In 1803 Warren wrote to the Collector of Chittoor;

Neither myself, nor the delegate which you sent me, were aware of any Poligar retaining still any authority, Civil or Military, in your Districts and, ... Narnicul Droog being one of my points, without any further ceremony, I directed one of my flags to be placed on that hill and the morning followed, intending to observe at that station.

No obstackle was offered me as I entered the bound hedge and Jungle which surrounds the Fort, but I noticed a number of men hurrying from the village...with matchlocks, swords, and daggers, who entering the jungle at various places met in my way...and opposed with great clamour my proceeding any further. I thought at first that they only wanted to see my passport [142 n.3], or that they questioned how far I was authorised by you to visit the Fort of Narnical Droog, but in this I was mistaken; they answered to all that I urged that I had no business there without the Poligar's leave, and that I must return to the village...until it was obtained, and meanwhile that I would meet with due attention there.

As it would have been vain to resist, I directed my bearers to return, and resolved on acquainting you with what had happened; I must add that I had no other attendants with me then but my palanquin boys, and that, having no mathematical instruments with me at the time, they could not have taken an exception to these.

The Collector replied;

Had I been aware of your intention to observe from Narcul Droog I could have informed you of the reception you were likely to experience from the Poligar there, who has been for some months back in a state of disobedience and refractoriness. ... I therefore think it would be improper to hazard an opportunity for the repetition of similar insult by insisting on accomplishing the object of your public functions in Naracul Polliam, and that it would be preferable to desist from the attempt[2].

Shortly after, Warren met with similar treatment at another hill in the same district;

Having had occasion to send a Flag to be placed on Bungarry Droog Hill near Muglee[3], I gave directions to my Lascars to that effect and, as you were so good as to assist me with a letter to the Poligar of that place, ... I concluded...that no possible objection could be made to its admission. To my no small surprise, however, the people I sent...informed me that... they were stopped by some Tannah Peons, who signified to them that they could not pass without the Poligar's leave. On this my Lascar delivered your letter which was conveyed to him by one of his own people. The poligar returned for answer that he could not allow the Flag to be placed in the Droog, by the reason that as it commanded a view of his habitation his women might be exposed to view. ...

As...I was prepared to meet with some difficulty, ... I had directed my Lascars in that event to place the Flag on another adjacent Hill...which would have answered equally well my purpose, but to this also the same objection was made on account of its commanding a view of the Pettah. The Poligar's men meanwhile pointed out a small Hill in the plain at some distance, and told my Lascars they could place their Flag there if they chose. ...

I must place myself on such hills as will descry preceeding and succeeding points. ... These

[1] DDn. 43, 4–6–07. [2] Letters of Sept. 25th & 27th, 1803; MPC. 14–10–03. [3] Mugali, 57 K/16.

in a hilly tract like this are generally the highest, and almost everywhere the stronghold of a Poligar[1].

In acknowledging this letter the Collector replied that,

from the consequences of the two trials you have now made of the temper of the Poligars, and from my own experience of their disposition, ... I see no ground to hope that the other Poligars will be actuated by sentiments different from...the Poligars of Naracul and Bungari. I would therefore dissuade you from any further endeavours to continue the survey in the Chittoor Polliams for the present [127, 238–9, 246, 358 n.4][2].

Lambton had then to inform Government that he had abandoned the attempt to carry triangles through Chittoor[3].

Two years later Kater met with trouble in the north-west of Mysore, and Lambton writes to the Resident ;

It is with serious concern that I have to acknowledge the receipt of your other letter... stating the disagreable and melancholy circumstance of a murder having been committed by one of the Sepoys of his [Kater's] guard. I have this instant dispatched two of the Amuldar's peons with orders to Lieut. Kater, directing him to proceed with all possible expedition to Kowlydroog, to investigate the charge, and to deliver up the Sepoy to publick justice, taking every person with him that can give the least information on the subject. ...

As I am induced to believe that this circumstance is entirely unknown to him, I have no doubt of his taking every measure in his power to arrive at the truth respecting this disagreable event, and also that he will produce a statement...that will...lessen the enormity of those acts of violence with which he himself has been charged ; for, though he may not be altogether prudent, yet I cannot help thinking, as you do, on the improbability of some of them[4].

To Kater he writes in a fatherly manner that

it will be peculiarly gratifying to me, if you can prove the falsity of those charges by which your character has been so darkened, and that you will be led from this to reflect how necessary prudence and forbearance are in our transactions in life, before we can attain what is truly desirable, the *just* reputation of being good and amiable[5].

In forwarding Kater's report he says that he felt

peculiar satisfaction from the manner in which Mr. Kater has acquitted himself. That giving exaggerated representations, and even false testimony, are circumstances which to my knowlege too often occur among natives of India, where there is any object of interest in view, but, where to all appearance no such object can exist, that one man should endeavour to swear away the life of another is inexplicable.

The concern which Lieut. Kater has felt...will, I am persuaded, make him particularly careful that no future acts of violence be offered to the inhabitants by any of his people, and I shall direct that the sepoys be forbidden such practices. I am well aware that servants and camp followers, if not kept under the influence of fear, are too apt to assume ; and, so forcibly was I impressed with this idea when I assumed this survey in 1801 that I made it a rule, if a complaint should be brought to me by an inhabitant, to inflict corporal punishment immediately on the person complained against, on the bare report of the complainant, presuming on the probability of his being right. I had occasion to put this rule in execution twice, which put a stop to all irregularities in my camp[6].

In commenting on this case Kater remarks that his

sepoys and followers having...remained *two days without food* requires some decisive steps to prevent the like happening in future.

The Dewan is not perhaps aware of the difference between this survey and others of an inferior nature, nor of the assistance which is sometimes necessary to the preservation of the valuable Instruments used, and the subsistence of the persons employed. The violent gusts of wind and rain prevalent in the western parts of Mysoor at the commencement of the Malabar monsoon render every precaution necessary. ... At Cowly Droog, the observatory tent was blown away, and the Instruments would have shared its fate, had not two of my coolies thrown themselves on the frame, and with difficulty preserved it. The case in which it is carried, though held by two men, was dashed in pieces on the rock.

Generally encamped near hills, at too great a distance from villages to send for provisions, it would be difficult to proceed without the accomodation of a Bazar from the nearest village. ...

At W— the danger from the wild elephants is known to be great, ... yet I was left there the first night of my arrival with only my own followers, who were then few in number. Fortunately

[1] DDn. 62 (54), 2–10–03. [2] ib. (53), 2–10–03. [3] MPC. 14–10–03. [4] DDn. 63 (120), 27–5–05. [5] ib. (122), 27–5–05. [6] ib. (125), 23–6–05.

during the time I remained there, which was two nights, these animals did not visit the hill[1].

District officials may well have been disconcerted at the amount of help which Lambton expected from them. He writes, for instance, to the magistrate of Nellore ;

I have detached Lieut. Hodge, one of my Assistants on the General Survey, to explore the Coast and interior from Nellore to Masulipatam, for the purpose of selecting stations [245–6]. In this service he will probably stand in need of some assistance from the police peons. ...

In the course of a few weeks a considerable part of my establishment under the direction of Lieutenant Riddell, who is conducting very extensive operations from Gooty to the sea-coast, will also enter the Nellore district, when he will be joined by Lieut. Hodge. They will then want considerable aid occasionally from the inhabitants, in clearing roads up the mountains, and will also want bazars to attend and remain with them. ... It will save much time and trouble if you will have the goodness to order all your Darogahs and other publick servants to attend to their applications, and allow one or two peons to be attached to them while they are in your district.

They will have to detach signal flags (blue and white) to different parts of the country, and it may be necessary to give some previous orders to prevent these flags, and the people who attend them, being molested ; Lieut. Garling reports that at one place his flag coolies were driven away by armed poligars. I could wish that such circumstances may if possible be prevented. ...

I shall myself enter the Nellore District in a few days with a large party on my way to Masulipatam, but I do not know that I shall traverse the country. However, if you will give directions to your public servants to attend to my wants, I shall be much obliged to you[2].

The very same official who made trouble with Kater in 1805 again raised trouble in 1813 with De Penning, whom he accused of having cut down a *pipal* tree[3] and of failing to pay for supplies. De Penning retorted ;

I have not as yet ascended any Pagoda or Place of worship in the Mysore, and I have always been very nice and particular on that subject, being fully acquainted with the delicacy of the Hindoos in preserving their sacred and religious places unpolluted.

The Amildar of Shicarpoor[4] saw me at Kowvaspoor before the flag was placed on the Pagoda, and as I was very Civil to that Chief, and he could speak the Tamil language perfectly well, in which language he conversed with me for some time, he could have easily told me that the Natives were averse to placing a flag on the Pagoda. ...

The report says that I left the Talook without paying for anything. This is a gross piece of falsehood, as I am confident that the Head Man of the village was paid by my servant, for, upon taking leave of us at Woodagunny[5], I questioned himself in his own language, when he acknowledged that he was paid satisfactorily, and had given in his receipt.

It is an invariable custom with me always to see the heads of the villages before we parted, and to question them myself, to know if they were actually paid, in order to avoid imposition on the part of my people, at the same time to give them an opportunity to state any grievance they may have met with. That the Inhabitants may not be frightened or impos'd upon, I always received the Headman of every village I came to into my tent, spoke to them in their own language, giving them to understand the nature of the survey, the probable length of time would be in their Talooks, the assistance I would require, and finally, if they should have any cause to complain of, I would remove the difficulty upon their letting me know in time.

A book is open for receipts, and every village receipt is booked by the Chiefs themselves after receiving payment, and...I have therein enclosed true copies of 3 receipts that were furnished us by the villages, acknowledging to have received payment for everything[6].

The case was sent up to Government, who informed the Surveyor General that they found the explanation satisfactory, though Lambton regretted that Government found

it necessary to send an officer as far as Shikarpoor to enquire, on the spot, into the grounds and particulars of these complaints. ...

In cases of this sort, however, ... some import must be attached to the respectability of the parties, and I think it but justice towards this young man to state that he has now been acting under my orders for fourteen years, and of late has often been detached from me ; and never before the present instance has there been a shadow of a complaint against him. ...

Upon enquiry I find that the Amildar of Shikarpoor is the very person who, in 1806, preferred in a most infamous manner a long list of complaints against Lieut. Kater, then my

[1] DDn. 91 (13), 5–7–05 ; cf. narrative by Brig. Sir Clinton Lewis, *Empire Survey Review*. No. 54 Vol. VII. 1944 (306–7). [2] DDn. 63 (267), 24–5–11. [3] *Ficus religiosa*. [4] Shikarpur, 48 N/7. [5] Udagane 8 m. NW. of Shikarpur, 48 N/7. [6] From Bilgi, 48 J/15, 20–11–13 ; MMC., 13–12–13.

Assistant, and among other heinous accusations, charged him with being instrumental to the murder of a man. ... So satisfied was Major Wilkes[1] of...Lieut. Kater's innocence that he wrote a publick letter to me in terms of the highest approbation. ...

With respect to placing flags upon pagodas, mounde in forts, etc., I have only to say that when I crossed the Peninsula in 1804–5, there was scarcely a pagoda or Droog in the Mysoor country that was not a station, and I never met with the smallest objection to placing flags, either on one or the other.

Even in the bigotted country of Tanjore, I ascended no less than twelve Coverams, and without those lofty buildings I never could have got through the country. At Ramisseram I was permitted to place the Instrument directly over the cell which contained the Sawmy, and all that too when there was a general apprehension of the Christian Religion being propogated[2].

Government was glad to learn that the complaints against De Penning were much exaggerated, but his conduct in striking the public servants at Chundergooty is considered to be highly reprehensible. ... You will impress both him and your other Assistants with the indispensible necessity of conducting themselves with justice and with gentleness towards the inhabitants of every District in which they may be employed.

You will further warn them that any outrage against the religious feelings of the natives will not fail to subject the offender to the severe displeasure of the Government[3].

Incidents of this unpleasant character were not frequent, and as a rule the surveyors met with all friendliness, such as the timely help De Penning received just before meeting the surly *amildar* of Shikarpur ;

Feb. 17th. 1813 ; Marched to Heereeor[4], on the Chittledroog to Serah road. ... Being short of cash & not expecting my supply for some time, I was obliged to borrow some money from the Shroff of this place, which I easily obtained through the Amildar, a very obliging sort of man. The sum of 20 pagodas was borrowed, and a bond for the same, payable in 15 days, was given to the shroff[5].

When planning extension into the Nizām's Dominions, Lambton was at some pains to gain the co-operation of the local officials, and suggested a visit to Henry Russell [248 n.9],

in order to state to you my particular objects and wants, that you may give full explanation to His Highness the Nizam, or the different Vakeels residing at his Court ; for unless there be a readiness everywhere to aid and accommodate, it will be impossible for me to carry on a work of this nature, especially if any obstacles be thrown in my way.

I am aware of the jealousy of all the native powers, as well as that of their subordinate chiefs, on seeing any description of survey carried on within their districts ; but, mine being of a more general and extensive nature than those which they have been accustomed to notice, and not embracing statistical objects, or such as excite their suspicion, I am in hopes that by a little address they may be induced to view it without alarm[6].

Russell replied that

the nature of the survey which you propose to make in the Nizām's Territories is certainly calculated to excite the jealousy both of his Government and of his subordinate officers, but I trust that your own caution and address, assisted by the orders I shall procure for you to the managers of the different districts you will pass through, will prevent the occurrence of any serious obstacle to your success. It will give me great pleasure to see you at the Residency, and to afford you every assistance within the reach of my influence and authority[7].

By the thoughtful arrangements and goodwill with which all preparations were made, as well as the tact of Lambton and all his assistants, work through the Nizām's territories progressed smoothly for the next three years and, after extending his great arc to Bīdar [249], Lambton was able to write ;

My excursion into the Nizām's Country was for the sole purpose of getting 3 degrees more to the Arc, and it was with some hesitation that I entered it at all, from being apprehensive of interruption occasioned by the jealousy of the inhabitants ; but all impediments have been removed by the truly liberal support which I have met with from Mr. Henry Russell, the Resident at the Nizām's court. ...

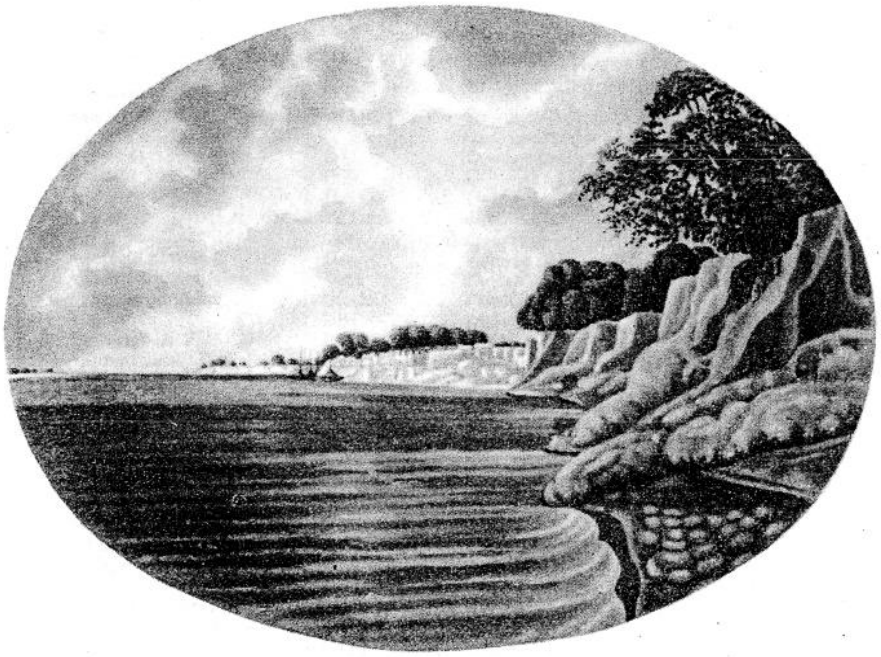
I at first indeed experienced some delays when my signal flags were sent forward, and that from not knowing in what district they might fall ; but when that happened, an order to the jaghirdar[8] was instantly procured from the minister, and the difficulty removed. But when it became generally known that I was not surveying their little districts, the alarm ceased, and I met with the same willingness to assist as I found in every other part of the peninsula, especially among the Gentoo[9] inhabitants[10].

[1] Mark Wilks, (1760–1831), Mad. Inf. ; Resdt. Mysore, 1805–7 ; *DNB.* ; *DIB.* [2] DDn. 63 (337), 18–2–14. [3] DDn. 64 (62), 4–3–14. [4] Hiriyur, 57 C/9. [5] De Penning's Journal. [6] DDn. 146 (3), 1–3–13. [7] ib. (4), 5–3–13. [8] land-holder. [9] Hindu. [10] *As R.* XIII (7).

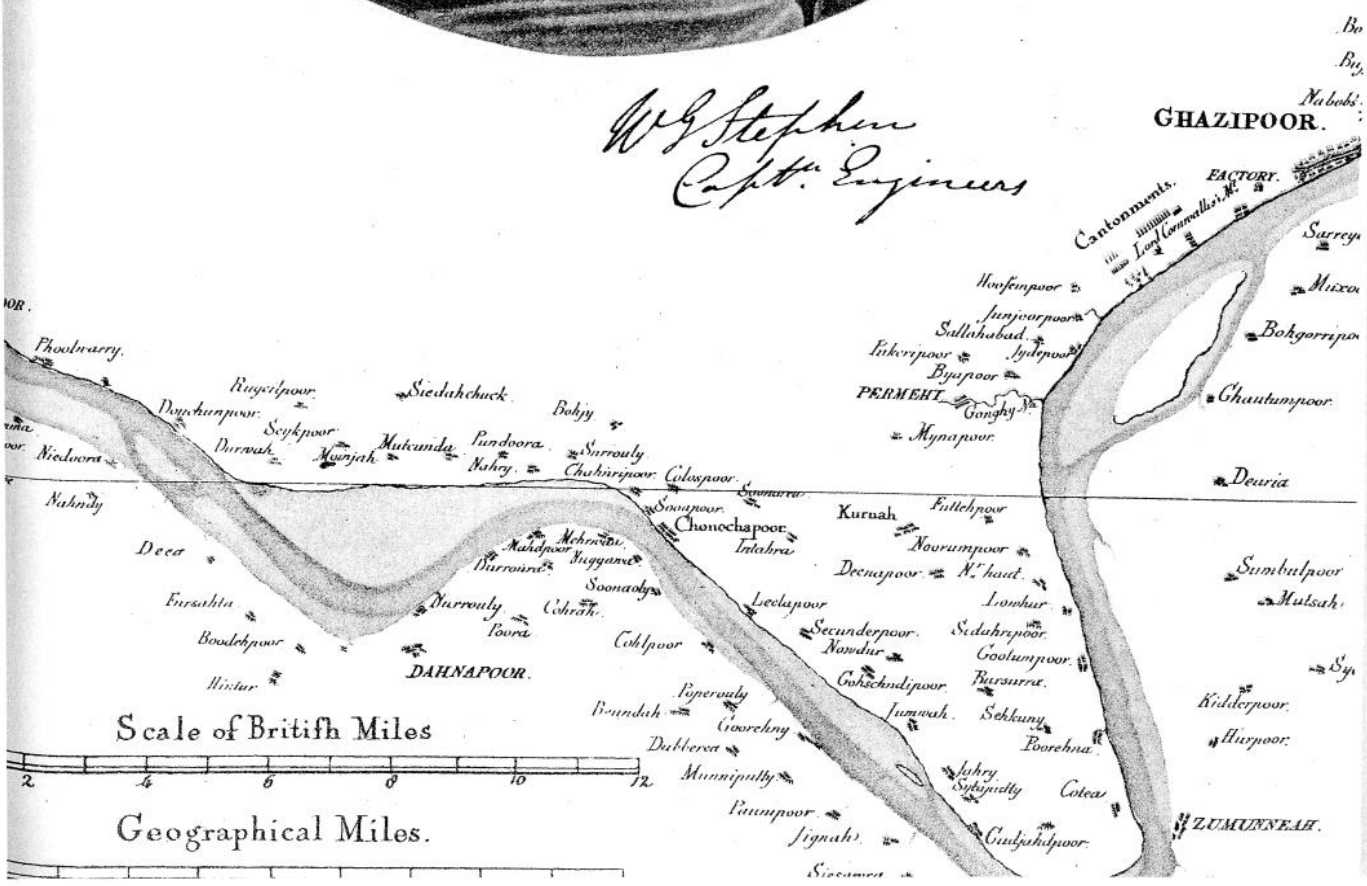
Part of Ganges &c.

Between the Mouths of the

GOOMPTY & GOGRA.



W. G. Stephen
Capt.n Engineers



Further Abbreviations

A D C.	..	Aide-de-Camp
A G.	..	Adjutant General
A G G.	..	Agent to Governor General
A P O.	..	Assistant Political Officer
A Q M G.	..	Assistant Quartermaster General
A R.	..	Astronomer Royal
A S B.	..	Asiatic Society of Bengal (now Royal)
A S G.	..	Assistant Surveyor General
Acc/d/y.	..	Accompan/ied/y
Actg.	..	Acting
Adjt.	..	Adjutant
Adm.	..	Admiral/admitted
Adm/n/ve	..	Administra/tion/tive
Adv/d/t.	..	Advertise/d/ment
Allce.	..	Allowance
Anon.	..	Anonymous
Appce.	..	Apprentice
App/d/t.	..	Appoint/ed/ment
Appn.	..	Application
Arr/d/g.	..	Arriv/ed/ing
Art.	..	Artillery
As Soc.	..	Asiatic Society
Asst/ce	..	Assistan/t/ce
Astr.	..	Astronomical
Attd.	..	Attached
Attdt.	..	Attendant
Auth.	..	Author
B C S.	..	Bengal Civil Srevice
Bo C S.	..	Bombay Civil Service
b.	..	born
bapt.	..	baptized
Barr.	..	Barrister
Bart.	..	Baronet
Batt.	..	Battalion
Bde.	..	Brigade
Bio.	..	Biograph/ical/y
Bkmr.	..	Barraékmaster
Brig.	..	Brigadier
Brit Assn.	..	British Association
Bro.	..	Brother
Bt.	..	Brevet
bur.	..	buried
C B.	..	Companion of the Bath
C E.	..	Chief Engineer
C O.	..	Commanding Officer
C P.	..	Central Provinces
c.	..	approximately
Cant.	..	Cantonments
Capt/Lieut.	..	Captain/Lieutenant
Cath.	..	Cathedral
Cav.	..	Cavalry
Cem.	..	Cemetery
ch.	..	Chapter/charge/chief/church
Chyd.	..	Churchyard
Civ.	..	Civil
cl.	..	class
co.	..	company/county
Col.	..	Colonel
Coll.	..	College
Collr.	..	Collector
Com.	..	Committee
Comd/d/g/r/t.		Command/ed/ing/er/ant
Comm/t/y.	..	Commissar/iat/y
Comn/r.	..	Commission/er
Comp/ns/r/g.		Comput/ations/er/ing
Contt.	..	Contingent
Corn.	..	Cornet
Corr.	..	Corresponding/ence
cr.	..	created
Ctml.	..	Courtmartial
D/A/Q MG	..	Deputy/Assistant/Quarter Master General
D C.	..	Deputy Commissioner
D D.	..	Doctor of Divinity
D S G.	..	Deputy Surveyor'General
d.	..	died
dau.	..	daughter
Dep.	..	Deputy
Dett.	..	Dettachment
Disch.	..	Discharged
Dist.	..	District
Div.	..	Divisi n
Dmn.	..	Draughtsman
Dsm.	..	Dismissed
dsp.	..	died without issue
E I.	..	East Indian
ed.	..	edited/educated
edn.	..	edition
Engr.	..	Engineer
Ens.	..	Ensign
Est.	..	Establishment
Ex/Engr/Offr.		Executive/Engineer/Officer
Expn.	..	Expedition
F L S.	..	Fellow of the Linnean Society
F R Ast S.	..	Fellow of the Royal Astronomical Society
F R G S.	..	Fellow of the Royal Geographical Society
F R S.	..	Fellow of the Royal Society
Fd Engr.	..	Field Engineer
Ft Wm.	..	Fort William
Furl.	..	Furlough
Fwkr.	..	Fireworker
G C B.	..	Grand Cross of the Bath
G C S I.	..	Grand Cross of the Star of India
G T S.	..	Great Trigonometrical Survey of India
Gen.	..	General
Gfather	..	Grandfather
Govr.	..	Governor
Garr.	..	Garrison
H E I C.	..	Honourable East India Company
H M.	..	His Majesty's
Hdqrs.	..	Headquarters
Ho.	..	House
Hon.	..	Honor/able/ary
Ht.	..	Height
I.	..	Island
Infn.	..	Information
Inst.	..	Instrument
Inst/n/r	..	Instruct/ion/or
Inv/d.	..	Invalid/ed
J A G.	..	Judge Advocate General
J P.	..	Justice of the Peace
junr.	..	junior
K C/B/I E.	..	Knight Commander of the / Bath / Indian Empire
K/H/L S.	..	Knight of the/Hanoverian Order/Lion and Sun
kd.	..	killed
Kt/Bach.	..	Knight/Bachelor
L L D.	..	Doctor of Laws
L R C S.	..	Licentiate of Royal College of Surgeons.
Lat.	..	Latitude
Lieut.	..	Lieutenant
Long/l	..	Longitud/e/inal
Lt.	..	Lieutenant/Light
Lt/Col/Govr.		Lieutenant/Colonel/Governor.
M. A.	..	Master of Arts
M A G.	..	Military Accountant General
M C S.	..	Madras Civil Service
M D.	..	Doctor of Medicine
M Gen.	..	Major General
M I.	..	Monumental Inscription
M M I.	..	Madras Military Institution
M P.	..	Member of Parliament
m.	..	married/mile
m c.	..	medical certificate
Mad Eur.	..	Madras European Regiment
Magte.	..	Magistrate
Maj.	..	Major
Mar.	..	Marine
Math.	..	Mathematic/al/s
Matric.	..	Matriculation
Mdpn.	..	Midshipman
Meast.	..	Measurement
Med.	..	Medical/service
Memo.	..	Memorandum
Merch.	..	Merchant
Mil.	..	Military
mo.	..	month
N B.	..	North Britain
N I.	..	Native Infantry
N P Gall.	..	National Portrait Gallery
N W P.	..	North West Provinces of Bengal
Nat.	..	Natural
n d.	..	not dated
nr.	..	near
O S.	..	Ordnance Survey of Great Britain
Ob.	..	Obituary
Obs/d/g/n.	..	Observ/ed/ing/ation
P A.	..	Political Agent
P S.	..	Private Secretary
P W I.	..	Prince of Wales Island, Penang

Further Abbreviations—(*Concld.*)

p m.	..	per mensem ; monthly
Preb.	..	Prebendary
Presd/t/cy		Presiden/t/cy
ps.	..	*pagodas*
Pte.	..	Private
Pymr.	..	Paymaster
R A.	..	Royal/Academy/Artillery
R A S.	..	Royal Astronomical Society
R As Soc.	..	Royal Asiatic Society
R E.	..	Royal Engineers
R M.	..	Royal Marines
R M/A/C	..	Royal Military/Academy, Woolwich/College, Marlow or Sandhurst.
R N.	..	Royal Navy
R S.	..	Royal Society
Recce.	..	Reconna ssance
Recd/d/g/n.		Recomend/ed/ing/ation
Regr.	..	Register
Regns.	..	Regulations
Regt/l.	..	Regiment/al
Repr.	..	Reprinted
Resd/t/cy	..	Residen/t/cy
Res/d/n.	..	Resign/ed/ation
Ret.	..	Retired
S E.	..	Superintending Engineer
S & M.	..	Sappers & Miners
S T S.	..	Superintendent, Trigonometrical Survey
Soc.	..	Society
Senr.	..	Senior
Sergt.	..	Sergeant
Sq.	..	Square
St.	..	Street
Sub-Asst.	..	Sub-Assistant Surveyor
Subsy.	..	Subsidiary
succ/d.	..	succeed/ed
Supd/g/t	..	Superintend/ing/ent
Suppt.	..	Supplement
Surg.	..	Surgeon
Surv/d/g/r	..	Survey/ed/ing/or
Svy.	..	Survey
Topo.	..	Topographical
tr.	..	transferred
Trig.	..	Trigonometrical
Trg/n/te/tg		Triangulat/ion/e/ing
Univ.	..	University
unm.	..	unmarried
V.	..	Vice
Vet.	..	Veterinary
viz.	..	videlicet ; that is
Vol.	..	Volume/Volunteer
yd.	..	yard

BIOGRAPHICAL NOTES

ADAMS, Henry. Bo. Inf.
b. 21–1–1789. d. 4–6–29, Sātāra.

Ens. 1–1–07 ... Bt. Capt. 1–1–18; Capt. 14–7–22.

Son of John Adams, of Aberdeen, seedsman.

m. 11–11–19, Christiana Louisa, sister of James Cruikshank [393].

March 1812, joined rev. svy. Broach [188–9, 323], and employed on rev. svy. till death.

ALVES, Charles George. Mad. Inf.
b. 8–6–1786. d. 21–11–62.

Lieut. 17–7–05 ... Lt Col. 20–7–36; ret. 17–6–41.

Son of John Alves, chamberlain to the Duke of Buccleugh, and Janet McPherson his wife; bro. to Nathaniel [*inf*].

m. 27–3–19, Miss Mary Browne.

April 1806, MMI., cl. II [320].

MMC. 28–10–08, appd. Travancore Svy. [132]; MGO. 14–2–11, rejoined corps.

Burmese War, 1825–6; survd. route Padaung to Taungup Pass; DDn. 219 (6), 30–6–26, "lately in civil charge of the Province of Bassein", submits map of Irrawaddy Delta, compiled chiefly "from information; ... forms a more correct map of the Delta than any we have before been possessed of"[1].

HMS. 672 (339), 5–3–30, Dep. JAG., Moulmein.

ALVES, Nathaniel. Mad. Inf.
b. 20–3–1788. d. 18–7–75, Jersey.

Ens. 20–9–05 ... Lt Col. 1–1–36; ret. 10–9–41.

Bro. to Charles George [*sup*].

Oriental Club.

June 1807, MMI., cl. III [320].

BMC. 24–4–10, arrd. Calcutta after sick leave to China; MMC. 29–1–11, rejoined corps from svy. under QMG.

1829, PA. Bhopāl; AGG. Rājputāna; June 1835, wounded in disturbances, Jaipur.

ARTHUR, Thomas. Mad. Engrs.
b. 12–5–1779. d. 1–5–17, Quilon, Travancore; MI.

Ens. 18–4–1796[2] ... Capt. 15–11–10.

Son of Rev. Robert Arthur, of Resolis, co. Ross, NB., and Anne, his 1st wife, dau. of Capt. John Munro of Braemore; an uncle in Madras 1803[3] was possibly her bro., Col. Munro of Pointzfield.

Mysore War, 1799; Siege of Seringapatam, under Mackenzie [qv] on N. batteries [I, 351]; with Warren [qv] on svy. of the fortress after its capture, till taken ill.

23–4–1800, appd. to Mysore Svy., joining Mackenzie at Bangalore, and with him on svy. of N. frontier [95, 97, 118]. 15–12–00, attacked by fever; Feb. 1801, to Madras, Mackenzie writing to Resdt.; "Mr. Arthur, whose zeal prompted him to remain, though lingering under the effects of a fever different from the agues that attacked the rest, at last was obliged to proceed to the coast by the decided opinion of the medical gentlemen. I heartily concurred in this as the only effectual way of getting rid of his complaint [98, 360–1][4].

Mackenzie writes to him at Madras, 30–5–01; "With regard to your coming up to Mysore, you can imagine I shall be very well pleased how soon you can attempt it with safety to yourself; but from your situation by your last, I think it would be very advisable to think seriously before you tempt the air of Ballaghaut [93 n.1]. I recollect being in July 1799 obliged to go down to the Ghauts for a similar complaint [I, 352]. But in this you ought by all means to consult the medical people, and follow *implicitly* their advice, without minding a moment what the busy world will say; besides, the work I have recommended will employ your time very properly at Madras as well as if you were up the Ghauts[5].

2–8–01, rejoined Mackenzie at Hiriyūr, going sick from 3–9–01 and employed on light duty, including trgn. and meast. of base-line at Dod-Ballāpur [98–100, 119–20, 366 n.7].

28–1–02, after repeated attacks of fever returned to Madras "Health continuing on the decline", granted leave, 8–7–02, for sea voyage to Penang. 7–1–03, returned to Madras, reporting there to Mackenzie, and moving up to Mysore in Feb. to take up svy. of Melucote Dist., N. of Seringapatam [102].

Complained of lack of asstce. from State officials, whilst they on the other hand said that his demands were unreasonable [105, 367–8]. This friction led Resdt. to ask that he should not work near the Coorg border; "the manner of communication with the natives excites considerable doubt in my mind of that Gentleman's using a sufficient degree of conciliation to qualify his holding any degree of intercourse with the people of Koorg"[6]. Arthur expressed deep regret, but the Resdt. was not satisfied; "Although, however, Lieut. Arthur appears to me to have failed in producing any substantial vindication of his past conduct, the earnest desire he has manifested...to regain...the good opinion he has forfeited, may be entitled to further consideration. Lieut. Arthur would seem to possess qualifications which, if properly directed and controlled, may be usefully employed".

Finding that his failure to pay for supplies could be "attributed to the agency of a native servant", the Resdt. ordered that "the absolute dismission of Ramchander Row from the service of Mr. Arthur must accordingly precede any permission for his being separately employed [368]. He found moreover that Arthur had been guilty of "personal violence towards the inhabitants; ... the effects of repeated illness may furnish some pretention, but no sufficient apology, for personal violence"[7].

Arthur continued svy. of dists. within reach of Seringapatam till 1805, when the Resdt. again complained of friction with local officials, and asked that he should be removed. Mackenzie, being much disturbed by these complaints, showed no sympathy with Arthur, and had him abruptly dismissed. Arthur writes to him on July 20th, acknowledging a "letter of the 18th, informing me that I am relieved from the duty of Assistant in the Survey of Mysore, which I had seen with no little surprize in General orders on my arriving at Panghur on the 16th inst., after having finished the field part of the Survey. ...

"This measure having taken place in so sudden a manner, without any idea of its being likely, or knowledge on my part of a cause existing, grieves me much. ... I cannot but suspect that it arose from some recent dissatisfaction on your part with my conduct on the Survey; ... you will therefore greatly obliged me by giving me some information on the head, that I may know the grounds on which I am thus separated from your command, to whom it was always my sincere wish to give every satisfaction"[8].

Mackenzie replied; "As you are pleased to intimate suspicion of your relief, ... while you refer to your wishes of always satisfying me, I must...observe that nothing was ever expected...of you by me beyond...cordial co-operation. ... For this I will refer to the whole of my own official correspondence and reports (ever since your restoration last year) & of the embarrassments attending that part of the survey.

[1] MRIO. 174 (7); cf. map, Crawfurd; HMS. 669 (175). [2] Conolly, 98 (87) gives 8–4–1796. [3] met by Mackenzie, DDn. 66, 17–4–03. [4] DDn. 41, 26–2–01. [5] DDn. 66. [6] DDn. 68 (313), 10–12–03. [7] ib. (327), 29–3–04. [8] DDn. 43 (127), 20–7–05.

"As my sentiments thereon were not unknown to you before I left Seringapatam last, any suggestion that I could be influenced by suppositions unsupported on the face of official documents appear to me inapplicable. ... Whether these motives...had influence in relieving you by an officer of your own Corps, who certainly never solicited for your appointment, is not for me to determine. ... And as you are proceeding to the Presidency you can there more properly obtain the information...you mention than is in my power to furnish, which, in preventing unnecessary correspondence, will enable either of us to turn our attention more effectually to our public duties [107, 368]"[1].

Though Arthur may have been unwise, his journal[2] shows him to have been of a simple and friendly disposition, by no means overbearing or aggressive. The following extracts show his keen interest both in the people of the country and their customs, and also in wild life.

"Sera. Dec. 3rd 1801. ... The Tomb of Malik Rahan, the first Mogul General who conquered this country, and built the present Fort at Sera :—the Building is a Mausoleum of blue stone with one or two Domes, well executed and neatly adorned with carved work. ... Under the rock on which the eedga[3] stands there is an extensive Cavern, from which tradition says there is a subterraneous passage to the Baba Buden Hills, and it is confidently asserted that a cock which was confined in the cave found his way underground to Shepagunga, and came out at another cave that opens there.

"The country about Sera abounds with Antelopes, foxes, deers, jackals, a few wolves, tigers, and a variety of water fowls ; Bustards are sometimes seen here, with a few Florikin. Many of the vallies are covered with date trees that afford a good shelter, and in some seasons food for a great number of wild hogs that inhabit them ; they are sometimes hunted by the natives, who have strong nets made of rope for the purpose, with which they surround the paths and openings in the thickest part of the jungle, which they then traverse in every direction with dogs, who rouse the game, and pursue them into the toils, which are so managed as to entangle them as soon as they come into them ; others are turned out of the cover into the open fields where they are run down by the dogs and then speared. ...

"Jan. 13th 1802. Having obtained leave to proceed to the coast I intended going on to day, but was prevented by a severe return of fever which obliged me to halt. ...

"Jan. 17th. Descended the pass today, and went as far as Saatgur, which I left on the 19th, and arrived by slow marches on the 28th at Madras, from whence some time after, my health continuing on the decline, I was obliged to take a voyage by sea [102] ...

"Feb. 11th 1803. Being now pretty well recovered of the severe and tedious illness with which I had been for a long time back afflicted, and which had obliged me to go to sea, I commenced this morning my journey towards Mysore in order to resume the Survey, ... and in undertaking it thus a third time I earnestly breathed a prayer that I might be enabled by a continuance of health to make up in some measure for the time which want of it obliged me to spend in searching after that blessing. ...

"15th. ... Streparmardore is a handsome, clean, village, chiefly occupied by Bramins attendant on a large handsome Pagoda here ; ... The Choultry at which I put up is about 2 miles further on, where are a collection of small huts, and a guard of Tannah Peons for examining passports and taking up straggling Europeans who have them not [142 n.3]. ...

"19th. On my arrival in the Choultry I found there a poor man lying on the ground with a broken leg, and almost starved for want of food and water. I learned on enquiry that this accident happened to him three days ago, since when he had been lying here without any person having the humanity to get him carried to Arcot, only 5 miles distant, where his relations were, or assist him in any other way, and, when I employed two men to carry him thither, the people here, who are mostly Bramins, expressed astonishment at my interesting myself about a complete stranger. ...

"26th. Continued my journey this morning to a Choultry at the Foot of the Pass with the intention of ascending it, but was prevented by the non-arrival of my bullock bandy with my stationery box, etc., which had broken down somewhere beyond Amboor[4], and obliged me to send some people and Bullocks to bring on the things. I was informed that the place was very much infested with thieves, but fortunately none of them paid me a visit. I shot several quails here, where they abound.

"28th. Although my bullock Bandy has not yet made its appearance, I went on this morning to Vencatgarry[5], as besides the inconvenience of want of supplies, this place has the Character at present of being infested with thieves who lately have robbed several people travelling this road. Milestones have lately been placed all along this road by Lt. Warren of His Majesty's 33rd Regt. [qv], late Assistant on the Mysore Survey, and entirely at his own expence, which certainly deserves the thanks of the public, as passing them successively makes the road less tedious.

"The distance to Vencategherry is 9 miles and very good. Around the latter place there are several tanks abounding with fish, and much frequented by Duck and Teal, the liberty of taking which is rented to particular persons by the Circar ; the wild fowl are here taken in nets, into which they are inveigled by strewing grain on the surface of the water. ...

"March 5th. Went on today to Bangalore, about 16 miles of very good road, but thro' a country perfectly barren to within a short distance of this place. ... Bangalore on my near approach to it appeared to be invelloped in mist, ... occasioned I suppose from its lying relatively low in the surrounding country. ...

"18th. Seringapatam. ... From hence, being near, I went to visit the ground where the advanced posts and enfilading batteries on the north side of the River were in 1799, and where I had served during the latter part of the siege of Seringapatam [I, 118, 351–2]. What a change ! What was then a scene of bloodshed and desolation is now converted into fine cultivated fields and flourishing gardens, and those trenches constructed for the purposes of destruction are now changed into streams of water [for irrigation]. ...

"25th. Set out to day from Nagmungulum [102, 208] with an intention of fixing a station on two hills about 5 miles from it, and as much from each other, but through the good offices of the Amuldar the guides and people I directed to go before to the first hill went to the other by pretended mistake, and the person sent along with myself to shew me the road led me with much difficulty on horseback to the top of a ridge of hills by a path which he said would lead me to the other hill I wished to go to, but when too late I found that this path was made by Tygers and other wild beasts to whose dens it brought me, where I got so entangled among rocks

[1] DDn. 43, 8–8–05. [2] DDn. 44 & GBO. Lib. Ab. 85. [3] *idgah*, muhammadan praying platform. [4] Ambūr, 57 L/9. [5] Venkatagiri, 57 K/16.

and bushes that it was with the utmost difficulty and danger to the horse that I got extricated, after running for two hours in every direction in search of an outlet[1]. ...

"27th. ... I shot today a beautiful small bird which I think is the bird of Paradise kind, of the size of a small lark, the back and tail of a reddish brown colour, belly white, neck and head crowned with a beautiful crest of a dark blue, bill large, rather broad in proportion, the upper jaw hooked at the point, with strong hairs issuing from its base; the tongue small and flat; large open ears; in the last there are two narrow feathers 9 inches long.

"31st. Many of these people who are called Bhyrage keep one arm straight out from their body with the hand closed, till the nails of the fingers grow thro', and curl up like so many horns at the back. One woman of this description coming hither on the road particularly attracted my attention; she was a well looked, rather young, girl, well dressed, and ornamented with the flowers of the Belputra and other ornamental shrubs; a wire of silver was run through both her cheeks and tongue so as to connect them (no bad cure for an unruly member), with something like a padlock to prevent its being taken out.

"But what especially engaged my observation was a number of people who attended her, some spreading webs of cloth on the road before her one after the other successively, over which she advanced without touching the ground with her feet, while others fanned her with chourys, at the same time sheltering her from the sun with a silken umbrella gilded all over, and every person that met her on the road made her a profound obeysance in the manner of adoration. ...

"April 8th, 1803. I this morning ascended...a rocky hill near Marphelly, and while adjusting the theodolite a large male bear, rushing from a cavern below me, almost upset me at it. He immediately turned towards me, and as he seemed inclined to do a mischief I discharged a musket at him, which I had fortunately loaded by me; this wounded and exasperated him so that he attempted to attack me, and, tho' gone to some distance from me, only just gave me time to load and fire a second time, which having upset him, I did the rest with the bayonet. Besides that I saw two more in this one hill. The country here is jungly and abounding with all descriptions of wild animals. ... The bear lives chiefly on fruit and honey. ...

"May 14th. ... Returned to Mailcottah[2] this morning through a very thick jungle in which I saw a very large animal of the deer kind, with branching horns of a grey colour, and spotted all over[3]. ...

"20th. ... A poor man was the other day carried away by a tyger in this neighbourhood, in the presence of his two daughters, who were doomed to witness the tragical fate of their parent without the power of yielding him any assistance. ...

"June 7th. This afternoon in the neighbourhood of Mullinghelly a very large bullock was killed by a royal Tyger in the presence of several people who could by no means frighten the savage animal from his prey. ...

"August 8th. Went this morning to a hill on the Seringapatam road about 10 miles from this place called Bebibetta, in order to ascertain the situation of several points that escaped me when here on the 7th April. A circumstance took place here which, altho' relating principally to myself, I hope to be freed from the charge of egotism in entering it thus in a public journal. ... This is an encounter I had to day with a Royal Tyger of very large size. ...

"Having placed the theodolite on the top of a rock at the summit of the hill, on the right declivity of which considerably below me all the people that had accompanyed me were sitting, I was looking through the telescope in the act of observing an angle, when a Royal Tyger, who had approached very near among the craggs on my left from the rear unobserved, had actually commenced his generally fatal spring towards me; at that moment fortunately I happened to look behind me, and seeing him in this act I had just time and recollection enough to throw my hat (the only thing at hand) in his face; the hat was surmounted with a black feather, and being so unexpected seemed to startle him, as although he had made his leap he fell a few yards short of me, and, as if ashamed of his failure, he immediately turned about and walked away roaring in a hideous manner.

"Most of the people along with me were so much alarmed by his roar, altho' few or none of them saw him, that it was with difficulty I could get them to move for some minutes. I pursued him a little way with a loaded musket in hope of getting an opportunity of shooting him from some of the rocks, but he soon disappeared among the bushes.

"I then after finishing my observations was preparing to descend the hill, but reflecting that an enemy in ambush was more to be dreaded then in the open field, and considering it probable that he might be lurking in our way, I determined if possible to rouse him as the safest plan. For this purpose I stationed myself, well armed and accompanied by a sepoy, about half way down the hill. I directed the people at the top to descend gradually making a noise and throwing stones among the rocks, but they were so possessed with fear as to be unable to do it with effect.

"After waiting in this way for some little time, I happened to throw a stone into a bush immediately before me, the furious animal who had concealed himself there rushed out towards us openmouthed, with a terrible roar. On quitting the bush he halted for a moment, probably to mark his first victim among us, and in that critical instant I discharged my piece, which I had the happiness to observe produced the desired effect, as the savage beast fell to the ground changing his roar into a groan; but fearing that his might be only a stun and knowing the danger of our situation in that case, I immediately ran up to him and, lodging the contents of a brace of pistols in his chest, I transpierced him with the bayonet which finished his struggles. Most of the few that had ventured down with me made a precipitate retreat at his appearance at this time, except a boy of the name of White from the Male Asylum[4], the Seapoy, one of my servants, and one or two peons of the Country.

"This was a very powerful male animal, measuring 10 feet 3 inches in length & required 20 people to carry him. ... Nothing was found in his stomach except part of the bone of a human hand. ...

"Oct. 5th. A Bramin belonging to this place was a few evenings ago bit by a Cabro de Capello snake 5½ feet long[5]. His friends came...to request some medical assistance from me, to whom, having no other stimulating medicine at hand, I gave 100 drops of Calputti oil diluted in two glasses of brandy, with directions to give the patient a little of this at short intervals as his stomach might receive it, and to apply a little of it dropped on cotton to the wound, after scarifying and cauterizing it with a hot iron.

"By the time they returned the effects of the poison had advanced so far as to bring on a locked jaw, and few signs of life were remaining; however, by persevering as instructed, and forcing some of the mixture down his throat by opening the jaw with a knife, sensation began to return in about ½ of an hour, when a violent fit of vomiting came on, and, the spasms subsiding, this was succeeded by a profuse perspiration, and by continuing to take a little more of the medicine, the effects of the bite entirely disappeared in a few hours, and he came in the morning to thank me in person. ...

"Dec. 20th, 1803. Understanding that the Survey of Arculgoda[6] was the next to be undertaken, situated on the Western Boundary of Mysore, here where it adjoins with the Dominion of Koorg [105], & not having procured hitherto a sufficient base in a

[1] cf. account by Morison [qv]. [2] Melukote, 57 D/10. Alexander White, survr. in the Deccan, 1818–22. [3] *chital*. [4] not recorded as apprentice surveyor; there was an [5] Cobra. [6] Arkalgud, 57 D/1.

convenient direction for establishing the situation of the hills in the western range, I am desirous of having a Station on the Mysore hill which, with the points to the Northwards, would answer this purpose. I therefore prepared to set out for that place, intending to take the liberty of spending a few of the holydays in Society in Seringapatam in my way, having sufficient materials to employ me in the interim, & in hopes that this indulgence would not be disapproved of [368].

"25th. This being Christmas day, the usual Ceremonies were observed, and I was sorry to remark that the beggarly custom which obtains so much among the Servants in Madrass, of going round on this day to Gentlemen's houses with presents of fruits, flowers, &c., in hopes of getting an usurious return, has spread its banefull contagion to this part of the world. ...

"31st. Employed in doing a little at the papers of the Survey, ... I discovered, to my great astonishment and disappointment, by a list of the Districts to be surveyed furnished me by Major Mackenzie, which had escaped me, ... that the whole of the present district of Madapoor...ought now to have been included in the same survey. This inadvertency I must acknowledge highly reprehensible, and...I must only rely for exoneration of this oversight on the indulgence of my superiors, and endeavour to remedy it in some degree by returning to complete that part as soon as possible.

"Jan. 1st, 1804. The new year was ushered in by the firing of cannon, and the day was spent in rejoicings usual on the occasion among Britons in every part of the world where they happen to be, and ought to carry the edifying reflection to every thinking mind that each revolving sun carrys us nearer to the awfull bourne of existence, and, as past time cannot be recalled, or future be depended on, it is their indispensible duty to improve it to the best advantage, so that they may look forward with hope to the day of retribution. ...

"18th to 24th. Was confined during this period by a severe indisposition; it was of the bilious kind, and only yielded to powerful medicines of the emetic and cathertic description.

"25th to 31st. For the first few days while in a state of convalescence, I was unable to do much at the survey, but when well enough I employed myself in bringing up the different papers belonging to it and, having finished the protraction part, commenced a fair copy of the map.

It was at this point that Arthur was called in at the request of the Resdt. [105, 367–8], and moved to an area closer to Seringapatam. He writes to Mackenzie; "It gives me much concern that my returning to finish a part of this district that escaped me at the time I reported the survey of Narsepoor[1] completed, should have met with your disapprobation. ... It is with the deepest regret I find that the disatisfaction I have had the misfortune of lately incurring has occasioned my being recalled from prosecuting a separate survey, but am not without hope that I may be indulged in the undertaking of another district"[2].

To continue the journal.—May 1804. Suffered much from fever and dysentery. "June 1st 1804. ... In descending, my attention was attracted by a very uncommon cry among the rocks near me that much resembled the howling of a tyger, which the natives along with me said was occasioned by the rock snake, a reptile that grows to an enormous size and is sometimes very dangerous, not from any deleterious effects of its bite, but from its immense strength and power and its carniverous appettite. It does not gnaw or dismember its prey, but swallows it entire, and its power of distension in this operation is wonderfull; frequent instances have been known of its swallowing a sheep, horns and all, and some are told of much larger animals. ...

"Oct. 9th, 1804. Finding myself extremely unwell and by no means recovering, I was carried to day to Hoolioordroog[3], as being more convenient in my present indisposed state than an obscure village in a very confined and unhealthy situation. On my arrival at Hoolioordroog I found there Major Lambton and Lieut. Warren on their way from Sevandroog[4] to Seringapatam in prosecution of their spherical survey [239].

"14th. Having constant rain falling during the whole of the day had so wet the mud terraces with which many of the houses here are roofed, that several of them fell, in consequence of the incumbent weight becoming too heavy for the wood intended to support it. This was the case with an old Choultry kind of a house with which I was furnished and obliged to put up in, as my tents were perfectly wet, and I myself confined to bed since my arrival here by the fever, which appears in no way abated.

"Very fortunately the cracking of the wood a little before it gave way warned me of the danger, and afforded me time to remove from the spot I was then in, the roof over which fell in about a minute afterwards, and after that in several other places. The situation to which I was now reduced was indeed deplorable in my then bad state of health. I was obliged to retire to a small corner of the Choultry which happened to be tiled, having the water running through every part, and scarcely a spot that did not leak sufficiently for my cot to stand in, and this was the case for several days while the rain lasted, during which time I understood there was scarcely a dry house in the Pettah, or Fort, a strong proof of the miserable stile of building that obtains here.

"17th. The weather now begins to clear up, and with it health begins to return to the party.

"Here again a number of natives were brought labouring under a variety of diseases, in hopes of being cured by the magic power of Feringi medicine. Among them was a fine young man in a very dangerous situation, whose youth and misfortune excited my pity, and determined me to try something for his relief, as he otherwise evidently must fall an early sacrifice. His complaint was stricture in the urethra at the bottom of the gland, which had entirely shut up the passage, and...he had a stoppage of urine for three days which, being total, must in a very few more have killed him. I therefore informed his father of the danger, and that nothing but piercing it with a sharp instrument could save him, as the operation of caustic was too slow. To this he having agreed, I introduced a silver bodkin with a sharp point, by mean of a small quill cut at both ends, until I felt the stricture, which I then pierced through by a sharp thrust of the bodkin, leaving the quill there. The poor fellow fainted under the operation, but was immediately compensated for all the pain by a free passage, which after so long a deprivation must have been a wonderful relief. I directed the quill to be continued, and occasionally taken out and annointed with oil till the wound was perfectly healed, which took place in a few days.

"I have mentioned this circumstance to show how much good may occasionally be done in this way by people with very little knowledge of surgery, and with the simplest means; and in such situations where no medical aid is accessible to the poor natives, who may be labouring under diseases themselves simple, but which become dangerous from neglect. ...

"18th. I was joined on my way to the hill this morning by Dr. Leyden [114–5], assistant on the

[1] Hole Narsipur, 57 D/1, 5. [2] DDn. 43 (46–7), Feb. 1804. [3] Huliyurdurga, 57 H/1. [4] Savandurga, 57 H/5.

Survey, whom Major Mackenzie...had been good enough to send to afford me medical assistance on hearing of my illness. ...

"29th. Made my baggage halt here today while I traced the course of the Covery for some miles down to where the Company's country crosses it on the north side. Within this space the river is confined in a very narrow but deep rocky channel, which the force of the water seems to have excavated. Here there is a kind of continued broken fall for nearly two miles, and it is so regular and narrow as to appear an artificial canal. In one place the whole body of the Covery...is confined in a space of about 10 feet broad, and a large rock impending over it here forms almost a natural bridge, in so much that tradition says the river was formerly crossed here by means of a creeper connecting with the extremity of the projecting stone and the opposite bank[1].

"Dec. 6th. Surveyed to day in a Southern direction fixing several points in my way; ... found a staff with a brush of small wood tied round it, which I was informed was placed there by Order of Mr. Warren, & therefore conclude it to be one of the points in his Survey [239].

"27th. Ascended this morning the hill Fort Cubbauldroog[2] & fixed stations on two of the highest points on its top. ... This Droog is naturally very strong, consisting of one single rock rising almost perpendicularly, ... inaccessible on all sides except the East, where there is a kind of natural Ramp, ... but so steep as only to be surmounted by a continued flight of steps. ... There are three walls built across the ascent at some distance from each other, with small doors in each, inside which guards were stationed when this was used as a State prison in Tippoo's time.

"On the top there is a flat of considerable extent surrounded by a wall on the edge of the precipice, inside which there is another enclosure surrounding the miserable hutts where many of our unfortunate Countrymen were confined, and several, including General Mathews [I, 125, 348], were here poisoned or otherwise put to death. On the top there are two tanks or reservoirs for water, one of which was kept for the use of the prisoners, and was the general receptacle for filth and everything that was noxious, in order to hasten the fate of those miserable beings whom they were anxious to report as having died a *natural* death[3].

"June 12th to 18th, 1805. I was, during this interval, disabled from doing anything to the papers of the survey by a severe complaint in my eyes, which for the time almost entirely deprived me of sight. Very heavy rain almost daily.

"30th. Had unfortunately a relapse of the sore eyes which, as the first attack, entirely disabled me during this interval".

The journal closes here, and two weeks later Arthur received a chilly note from Mackenzie; "Having received intimation of 3rd inst. from the Secretary to Government that you are relieved of the duty of Assistant on this Survey, it will be unnecessary for you to proceed any further with that you were directed [107, 368, 376–7, 421]"[4].

For the next two years was employed on engr. duties at the Presidency. Oct. 1805, sent to examine a lead mine in the Nellore Dist., and in Dec. submitted report on lead and copper mines "near Jungumrajpilly"[5]; MPC. 21–10–06, "still confined at the Presidency by a severe indisposition contracted during his residence at the Mines".

MGO. 28–7–07, appd. Survg. Engr. with dett. at Travancore [331–2]. Employed from June to Nov. reporting on buildings at Vellore, afterwards proceeding to Travancore, where he made various surveys himself besides supervising work of officers from the MMI. [131–2]. MGO. 4–2–09, thanked "for distinguished conduct in action at Quilon", 15–1–09.

Supdg. Engr. Travancore; 1815–6, svy. of disputed boundary, Travancore–Cochin.

Ward met him two months before his death; "Capt. Arthur has some work in hand on the Geography or History of the Country. ... I have had occasion of seeing him several times while at Trivandrum, ... but he did not seem inclined to say much, and I am almost assured that I will not be able to obtain any information or assistance from him on any subject, as he appears to me to be very reserved on all points. He is a great favourite with the Resident[6]. ... Capt. Arthur is a great mineralogist, & has lately discovered a Coal mine, or rather of chas'd wood, at Hurkulla. ... His friend Dr. Heyne [113–4]...came down last month., & an inspection has pronounced it to be good coal".

He writes again after Arthur's death; "Poor Capt. Arthur's effects will be sold in a few days. ... He has left behind him a valuable Library; the books will sell well, as they generally do at out stations"[7].

Bequeathed "to...a Moor Girl orphan, who has followed my fortunes for 14 years, 800 Star Pagodas"; the remainder to his family in N. Scotland[8].

BAKER, Godfrey Phipps. Ben. Inf.
b. 1786. d. 4–8–50.

Ens. 1–10–01 ... Lt Col. 22–4–27; ret. 21–1–31.

Son of Hugh Cossart Baker, of Limacue, co. Tipperary, Capt. HM. 27th Foot.

m., Chandernagore, 22–7–17, Mary Lydia Dubois de Saran, dau. of the Registrar.

Hodson, I (77–8); *Oriental Club*.

1811; with Ben. Lt. Inf. Vol. Batt. to occupation of Java [323]; 1812, at Jokyakarta[9], employed by Resdt., John Crawfurd[10], "for a few months in making plans of the neighbouring Country, such as would answer military purposes, tho' without the employment of instruments. This could in my opinion be effected without giving any unnecessary alarm to the Sultan"[11].

JMC. 17–1–14 (5), appd. Supdt. of Buildings at Solo. 1815–6, frequently employed on svy. in S. Java, occasionally co-operating with George Everest [137–8, 216–7].

10–6–16, left Batavia for Calcutta, remaining there for several months preparing map of Java.

1824, Asst. Sec. to Govt., Mil. Dept., Ft. Wm.

BARTON, Ezekiel. Ben. Inf.
b. 4–12–1781. d. 4–6–55.

Ens. 21–10–1800 ... M Gen. 3–11–41.

Son of George Barton.

Hodson, I (99).

1814, probably on account of his talent as artist, aced. Lady Hood and Mackenzie on visit to Dehra Dūn, meeting Hodgson [408] who writes; "At Sunsar Dara[12]...Lady Hood & Lt. Barton, Draftsman, took good views of it, as well as of other picturesque scenes. Her Ladyship left Hurdwar for Calcutta this morning, via Moradabad, Bareilly, &c."[13] [83, 436].

[1] Goat's Leap, 57 H/7. [2] Kabbal Durga, 3,500 ft., 57 H/7. [3] cf. reports on Nazi concentration camps, 1942–5. [4] DDn. 43, 18–7–05. [5] MMC. 21–10–05; cf. Dr. Heyne [114]; *Imp Gaz.* XIX (16). [6] John Munro (1775–1858) [196 n.4]. [7] DDn. 156 (212), 6–6–17. [8] Mad. Wills, 1817. [9] on S. coast, 110° E. [10] (1783–1868); Ben Med. 1803; PWI. 1805–10; Java, 1811–6; Ch. Comnr. Rangoon. 1826–7. [11] J Misc C. 12–4–12. [12] Hot Springs 8 m. N. of Dehra. [13] DDn. 136, 29–3–14.

28–5–14, Hodgson asks for Barton as asst.; "Lt. Barton... is exceeded by no one as a Draftsman, either in taking views, or giving to Maps and Plans an exquisitely beautiful finish. His drawings Lady Hood will show you, and in your office may be found his plan of the Bareilly Cantonment.

"Mr. Barton wishing to be found in a situation where he may have room for these talents is desirous (if he does not go to England) of being my assistant. As he has long been a Quartermaster & is next for promotion, the small allowance is no object to him, his desire being to lead this sort of life, &, if he could be appointed, the Department would gain a most valuable aid in his pencil. ... With his assistance in ornamenting the Maps, they would, I flatter myself, make them better worthy of the inspection of the Directors. I observe most other Surveyors have assistants; could Mr. Barton be appointed mine, I would be very glad. ...

"Lady Hood is very desirous that Barton should go with her & Sir Samuel overland to England, but in the chapter of accidents there may be some to obstruct that plan[1]; at any rate Barton will have the advantage of Lady Hood's influence with Lord Moira"[2].

Barton abandoned his intention of taking leave, and under BGO. of 5–11–14 was appd. Asst. Survr. to Hodgson, with whom he joined Marley's column at Dinapore for the advance to the Nepāl frontier [41–2]. Hodgson writes on the journey up the river, 16–10–14; "We have had a hard Tug to get so far; we shall be at Monghyr this night, I think. At Monghyr we shall learn everything about the expedition; at Boglepour it was guessed that there might be peace. I think by the 24th we shall be at Dinapour [408]. ...

"Barton is putting the finishing hand to the copy of the Map [of the Dūn], & I will send it from Dinapour; he is making great progress as a practical Astronomer; with the 2 reflecting circles we observe the Latitudes of all places of any note where we bring to at nights [42]". And again, 22–11–14, "I have got on so far, & shall be at Dinapour to-morrow. ... I send the map. ... Barton took great pains & trouble in making it look so well, but it took up a vast deal of time as you may suppose; ... the labour on the mountain part was great [pl. 10][3].

Whilst survg. along the Nepāl frontier Barton lost his theodolite—"the enemy have got it"—and he had to send the SG. a draft for Rs. 1,200 for another; April & May 1815, on svy. of frontier between Bāghmatti & Tista rivers [311]; rejoined unit 31–5–15[4].

BGO. 22–12–15, at Hodgson's request appd. Asst. on svy. of Garhwāl, Sirmūr & Hindur[5] [84], but under BMC. 1–3–16 (84), allowed to resign on account of ill-health, taking sea-voyage, extended to Europe.

From 1–1–17 on QMG's staff, controlling various mil. svys. ... Dec. 1817, Jan. 1818, with Ochterlony's "reserve Army" to Jaipur, helping Hodgson once more with svy. and astr. obsns.

BAYLEY, James. Mad. Inf.

b. 5–7–1783. dsp. 11–8–45.

Lieut. 21–9–04 ... Maj. 21–6–27; ret. 4–7–29.

Son of James Bayley of Manchester (ancestor of Sir Steuart Colvin Bayley and other distinguished Indian servants), and his wife Margaret, dau. of James Hodson[6], of Hodson's Court, Manchester.

The Bayley Family; Family Records. Oriental Club.

April 1805, MMI. cl. I [320]. Dec. 1807, posted to Lambton's General Survey; 1808, ran 2ndary. series of triangles across peninsula from Tanjore through Coimbatore to Malabar coast [242]. 1809–10, minor trgn. Trichinopoly, Madura, Tinnevelly, etc., rejoining Lambton at Pondicherry, July 1810 [243–4]. Zeal and ability commended by Lambton [243, 322].

MGO. 9–4–11, appd. to Java expn., attd. to HM. 14th Foot; March to Aug. 1812, in ch. of Barrack Dept., having to "visit the Telegraph[7] a great part of that time". J Misc C. 14–9–12, appd. AQMG., Java [320, 323]; constructing barracks at Cornelis, and unofficially survg. environs of Batavia [135–6, 294, 301–2].

J GO. 4–9–13, being AQMG. Madras Est., ordered to Madras, but asked to return via Bengal; "I have been now nearly nine years in the Service without having been ever absent from my duty; and...as I have had several severe attacks of Fever during my Residence in Java, I conceive that a short stay during the cold season in Bengal would be of material service to my health[8]".

Before leaving, took part in expn. against Sambas[9] on W. coast of Borneo, being thanked in despatches of 3–7–13 for gallant conduct in leading the column and "cutting a passage thro' the jungle"[10].

Acctd. Gillespie on tr. from Java, being granted, MGO. 8–2–14, leave to be absent on duty in Bengal. On Gillespie's staff in the Upper Provinces. On returning to duty with Madras Army, was due to reach Allahābād 10–8–14, and authorized to svy. route through Rewah and Nāgpur to Jālna [53–4][11].

Foster (51), serials 207–8 at 10., coloured prints of Battle of Sitābāldi from drawings by James Bayley.

BIRCH, George. Ben. Inf.

b. 25–8–1781. d. 23–2–55.

Ens. 25–10–1799 ... Maj. 11–7–23; furl. 1822; ret. 15–1–24.

Son of Rev. Thos. Birch, DD., and Mary Wright his wife.

m. 15–6–31, Lydia Diana, dau. of S. F. Dashwood, of Stanford, Notts.

Hodson, I (143–4).

Oct. 15–29th, 1806, survd. route of 23rd NI. Bareilly to Agra.

BSC. 4–7–15 (11), APO. with Ochterlony, Garhwāl, Sirmūr, & Simla Hills, till 1822. *Ben Regr.* 259 (101) Map of Jaunsar & Bāwar [90 n.13], 1816.

BISS, William. Mad. Inf.

b. 1783. d. 8–8–19, Kutālum, Tinnevelly.

Lieut. 21–9–04; Bt. Capt. Jan. 1818.

Son of William & Susannah Biss.

m., Madras, 15–10–10, Julie Ormsby.

April 1805, MMI., cl. I [320]; 1807, to svy. of Travancore [131]; MMC. 28–10–08, having been granted 3 mo. leave to Pondicherry, "has not yet reappeared"; MGO. 17–11–08, "removed from his situation on the Survey of Travancore... to join his Corps". 18–10–11, Asst. in QMG.'s office, AQMG.

[1] The Admiral's death provided that accident [83 n.8]. [2] MRIO. M 575. [3] DDn. 136. [4] ib.; Hodgson to SG. 9–6–15.
[5] old name of Nālāgarh State, Simla Hills. [6] ancestor of Major V. C. P. Hodson, auth. of *List of Officers of the Bengal Army.*
[7] Visual signalling. [8] JMC. 28–5–13. [9] 109° E., 1° 20′ N. [10] JMC. 28–7–13. [11] B Pol C. 4–11–14.

BLACKER, Valentine. Mad. Cav.
b. 19–10–1778. d. 4–2–26, Calcutta ; MI., S. Park St. cem.

Corn. 29–8–1789 ... Lt Col. 20–10–23.
SG. of India, 1823–6 [112, 282].

4th son of Rev. Dr. St. John Blacker, rector of Moira, co. Down, by his first wife Grace, sister of Barry Close (1756–1813), Mad. Inf. [49 n.12] ; bro. to St. John Blacker (1785–1842), Mad. Cav. ; descended from Capt. Valentine Blacker, of Blacker Hall, Yorks. & Carrick Blacker, co. Armagh, Comdt. of Horse & Foot under Charles I.; his sister Charlotte m., Madras, 3–12–08, John Munro (1775–1858) QMG. [196 n.4, 380 n.6].

m., Madras, 22–12–13 Miss Emma Johnson, who survived him with several children. CB.

DNB. ; DIB. ; EIMC. I (323) ; portrait in possession of family, Elm Park, co. Armagh, 1936 [vol. III].

1799, Mysore Campaign ; with cav. of Nizām's army. 1800, with Stevenson's column on W. frontier of Mysore.

23–5–01, with Agnew against *poligars* in Tinnevelly, "Lt. Valentine Blacker of the 1st Cavalry...was piked in two or three places ; but...he would not desist until our trumpets had sounded the recall". 7–6–01, "Lt. Blacker's troop which had been in front of the rearguard, came up and got orders to charge a party firing from behind a choultry, which they did in gallant style, ... during which skirmish Lieut. Blacker received a slight wound in the leg near a former one not quite healed"[1].

1803, appd. AQMG. & Capt. of Guides, serving through Marātha War. 1804–6 ; compiled map of part of Chittoor Dist., other maps bearing his name being *Sketch of the country between Seringapatam & Coimbatore*, 6 m. an inch, 1810, and *The coast from Anjengo to Parka*, undated [123].

Aug. 1806, appd. DQMG. [313] ; Jan.–March 1809, on special duty in Travancore during suppression of disturbances [132]. Feb. 1810, at Sironj with Madras survrs. attd. to Close's force from Poona [50].

April 1810, appd. QMG. Madras Army, holding appt. till furl. to England, 1819 [275 n.8, 352]. Throughout his connection with QMG.'s Dept. took particular interest in svys. and mapping ; 1810–1, had spirited dispute with Mackenzie and Morison, regarding responsibility for maps [53, 128 n.3, 275, 291].

His name is still given to *Blacker's Gardens*, Teynampet, Madras, a plot of 9 acres taken up by him in 1806 on the west side of Mount Road, opposite cath[2].

BLAIR, John. Mad. Engrs.
b. 23–3–1774. d. 23–3–12, at sea.

Lieut. 23–2–1793 ... Bt Maj. 25–4–08.

Son of Rev. Dr. John Blair, Preb. Westminster Abbey, & Anne Persode, his wife.

ed. Westminster, *OW.*, I (95).

MMC. 8–3–05, appd. Engr. & Survr. Travancore [131, 225, 358] ; survd. small area near Trivandrum which Ward later found "very accurate". MGO. 14–1–07, appd. Engr. & Survr. with Hyderābād Subsy. Force [134, 312–3, 332]. April 1811, being relieved of this charge and having applied for furl. on mc., offers his survg. insts. for sale to Govt. ; "I am happy to dispose of the Instruments on any terms, as I am scraping as many Duties [?] together as I can. The rest I shall send to some shop at Madras, and see what I can catch for them"[3]. Govt. paid 138 *ps.* for his sextant and theodolite.

BLAKE, Benjamin. Ben. Inf.
b. 6–8–1788. d. 12–3–38, Siwa Oasis, Egypt, *en route* to England.

Son of George and Ann Blake of Portsmouth.
Hodson, I (162) ; II (622).

1808–9, survd. Metcalfe's route to Lahore [62] ; 1809–10, survd. various routes with his batt., Rewāri to Sahāranpur, Sahāranpur to Karnāl, etc. [36], the magte. reporting, "Lieutenant Blake has not been officially...under me, but...I availed myself of a very polite offer of that Gentleman's to accompany me on a tour of the District, and to make a correct map of it"[4].

June to Dec. 1810, "Employed during my illness during the remaining part of this year in protracting off my surveys on the large scale, also furnishing to the CO. one of this District".

19–3–11, survd. up to Kālsi [Kaulsee, pl. 3] on the Jumna, and sketched the foothills [36, 82].

Dec. 1811 to March 1812, at Calcutta completing map of his svys. with some assistance. In submitting this to Govt. SG. comments ; "It has been compared with the other documents in the office, and from its approximation to them, may be considered as accurate, and as doing credit to Lieut. Blake who undertook so extensive a work. Beginning his survey in a country into which no European and ever before entered, and which might in future be inaccessible, he was unwilling to let pass such opportunity of being useful"[5].

Govt. replied ; "The labors voluntarily undertaken by Lt. B. Blake...in taking Surveys in the upper Part of the Dooab are highly creditable to that officer, but no allowances can, consistently with the Regulations or usage of the Service, be granted to him as a remuneration, as he was not publicly directed to undertake the Work"[6].

As some compensation, however, Blake was appd. Survr. in Gorakhpur, to succ. Webb who had gone home sick [34–5, 311, 366]. His work met with much criticism from the SG. [35, 201, 219–20], who remarked that his earlier map "was copied, printed, and decorated by my head Draughtsman"[7].

Took obsns. to determine position and height[8] of Dhaulāgiri [6, 87]. Relinquished svy. to rejoin batt. for Nepāl War ; severely wounded at Kalanga, 27–11–14 [90].

BGO. 15–11–16, furl. to Europe.

BLAKISTON, John. Mad. Engrs.
b. 8–2–1785, Dublin. d. 4–6–67.

Lieut. 1–1–06 ; ret. 28–7–15.

Son of Sir Matthew Blakiston, 2nd Bart., & Anne, dau. of John Rochfort. ed. Winchester & RMA.

m. 26–9–14, Jane dau. of Rev. Thos. Wright, Rector of Market Bosworth, Leics.

DIB.

[1] Welsh (76, 82). [2] Penny ; Love (561). [3] MMC. 13–9–11 & DDn. 127 (52). [4] DDn. 82 (240), 30–5–10. [5] DDn. 128 (57), 7–3–12. [6] BMC. 11–4–12 (32). [7] ib. 14–10–14 (107). MRIO. 31 (22), SGO. copy of Blake's svy. [8] ht. 26,810 ft. ; 62 P.

Jan. 1802, Embarked for India ; chose Engrs. as affording "better opportunities of acquiring a Competence". 1802, survd. several forts of Ceded Dists.

Marātha War ; 23-9-03, writes that just before battle of Assaye, "on arriving at the village...where we were to have halted that day, the Quarter Master General had...marked out the Camp, and I was employed in my customary duty of surveying the ground" ; slightly wounded at the battle.

Dec. 1803, survd. Wellesley's route Berār to Poona, 120 m. in 5 days [165].

10–7–06, escaped alone from Vellore massacre, and returned to the rescue from Arcot with Gillespie [135 n.4].

1809–10, with expn. to Mauritius, returning to Madras Jan. 1811. Appd. ADC. to Sir Samuel Auchmuty, C-in-C. Madras, sailing on expn. to Java 30–4–11 ; arrd. Malacca 1–6–11. With Mackenzie [424] on recce. landing at Chillingching, Java, 14–7–11, recording detailed account. At storming of Cornelis "blown some distance by an explosion in the Redoubt". Returned to Madras before end of 1811.

Feb. 1812, left Madras [230]. March 1813, joined Wellington's staff in Peninsula ; posted to a King's Regt. resigning in 1815.

Auth. of *12 Years of Military Adventure in Three-quarters of the Globe*, 2 vols. 1829, and of *Twenty years in Retirement*. 2 vols. 1836.

BLANE, George Rodney. Ben. Engrs. b. 7–1–1791. d. 18–5–21, Ludhiāna.

Ens. 18–3–08 ... Capt. 1–9–18.

3rd son of Sir Gilbert Blane 1st Bart., physician in ordinary to George III, and Elizabeth his wife.

ed. Charterhouse & Marlow.

Hodson, I (165) ; II (632) ; Sandes, II (3–4).

BMC. 28–3–08, provisionally appd. to Engrs., but to do duty with Art. at Ft. Wm.

BGO. 11–11–09, appd. Asst. Survr. under instruction with Sackville in Cuttack ; returned to the Presdcy. June 1810, "able to conduct any survey himself" [19, 24–5, 192–3]. 1811, survd. Sāgar I., extending this svy. to the E. during 1813 [15–6, 177–8, 202, 311].

1814–5, Nepāl War ; Survr. & Asst. Fd. Engr. to 2nd Div. Dehra ; wounded at Kalanga, the only Engr. officer present. With Ochterlony's column survd. Sirmūr and Chakrāta. From "before Jytuk" 3–4–15, submitted results of a tour with Wm. Fraser, [90] ; "This division has been stationary, & I was not permitted to prosecute my researches alone. Mr. Fraser has in a measure the control of the irregulars, and by his means we were provided with a very respectable escort from this force. ... Up to our knees in snow"[1] [398].

2–7–15, reported arrival at Sahāranpur, on the way to Ludhiāna, to which station he was appd. late in 1814.

Urging the value of the old Jumna canal through Karnāl to Delhi, survd. by Macartney [69, 418], Blane was employed from 1817 till his death on restoration of this canal.

By will made in 1814, he left property to his father, but "all effects in Camp & in Delhi to my friend Lieut. Lawtie" [415] ; his chronometer and telescope to Lawtie and Wm. Morrieson, both of whom died very shortly after.

BLUNT, James Tillyer [I, 313]. Ben. Engrs. b. 1765/6. d. 20–10–34.

Ens. 15–2–1785 ... Capt. 1–1–06 ; ret. 9–2–10.

ed. Merchant Taylors', 1774–6.

m., Calcutta, 3–9–1796, Mary Bristow, nat. dau. of John Bristow (1750–1802), BCS., and sister-in-law of R. H. Colebrooke [386].

EIMC. III [290] ; Hodson, I (170) ; III (746) ; IV (631).

1787, asst. to Reuben Burrow on astr. svy. [I, 157–8] ; 1792–3, asst. to Thos. Anburey on route svy. Hyderābād to Kālpi [I, 116] ; 1793–4, asst. to Chas. Reynolds on svy. Allahābād to Pānipat and back to Lucknow [I, 132] ; 1795, survd. route Chunār to Rājahmundry [I, 56–63 ; II, 286] ; 1796–1801, 4th Asst. to SG. [I, 271 ; II, 266, 386] ; 1798, Bkmr. Ft. William.

Jan. 1800, on com. to inspect insts. bought from Dinwiddie for Lambton [252].

Nov. 1801, applied for active service with expn. to Egypt [393] ; "I am at present labouring under an asthmatic indisposition, but I will be equipped and ready to embark whenever it may be required ; ... my health is really but feeble from agueish attacks acquired while I was on duty at Fort Mornington, which have scarcely failed to harrass me at almost every change of the Moon, for the last six months. ...

"I have been attached to, and actually done much laborious duty in the arsenal of Ft. William for 5 years ; ... the Commissary of Stores will bear testimony...to my continual and successful exertions during the last nine months in improving the manufacture of Brass Guns in the Foundry" ; but Govt. judged it "to be adviseable not to take Capt. Blunt from his present employment"[2].

Two years later posted to Harcourt's force engaged in conquest of Cuttack and Orissa from the Marāthas [23, 418]. Aug. 1803, OC. reports "I have selected Capt. Blunt...to act as engineer and surveyor on the present service, as he has surveyed the province of Cuttack, and possesses much local information"[3].

Oct. 1803, mentioned in despatches for services as fd. engr. at capture of fort of Barrabutty[4].

Oct. 1804, selected for special duty in Khurda, Col. Harcourt reporting ; "I have been induced to select Capt. Blunt for this service from knowledge of his diligence, moderation, and ability ; from his being perfectly conversant with the native languages, and from his long residence in Cuttack, and confidential situation with me, being well acquainted with the whole of the transactions in respect to the Khoord Rajah"[5].

June 1805, returned to the Barrack Dept. at Ft. William, and in 1807 "after almost 24 years service in India without furlough, his constitution being greatly debilitated, he took leave to Europe, ... and seeing no further prospects of promotion he retired" and settled in Devonshire[6] ; accd. home by wife, 3 daus., and a son.

BORIAH, Kavali Venkata[7], Brahman. Mad. Translator. b. 1776. d. 1803.

Son of Kavali Venkata Subbiah, of an Arvela Niyogi Brahman family. Had 3 bros. in service of Colin Mackenzie, Narayanappa, Lakshmaiah, and Ramaswamy[8] [355–6], and another bro., Sitayya, whose descendants lived in Madras many years later. A sister m. *zamīndar* of Vissannapettah. [356].

m. younger sister of Venkata Chalam, *zamīndar* of Kasimkota Dist., and left an only dau.

ed. at "Mr. Morgan's school" at Masulipatam, and employed there as writer in office of Mil. Pymr.

[1] MRIO. M 575. [2] BMC. 20–11–01 (80). [3] Gurwood, III (406). [4] BSC. 1–3–04 (54–5). [5] BS & Pol. 4–4–05 (1–9). [6] *EIMC.* III (292). [7] Mostly from infn. by Prof. C. S. Srinivasachari. [8] Venkata Ramaswamy, auth. of *Biographical Sketches of Dekkan Poets*, pubd. Calcutta, 1829.

Took service with Mackenzie at Hyderābād, and, 1797, kept journal of march to Madras on Mackenzie's journey to become CE. of Manila expn. [I, 350].

1798–9, with Mackenzie on Mysore campaign; present at seige and storming of Seringapatam, and described "in animated verse" the planting of the British colours on the ramparts [I, 118, 350–1].

1800, with Mackenzie on Mysore svy. to frontier NW. of Chitaldroog [94–5]; wrote poem on defeat of Dhoondia Waugh by Wellesley, and an account of Seringapatam and its rulers, *Srirangaraja Charita*.

Employed by Mackenzie in collecting and translating historical MSS [355]; was a keen coin collector, skilled at deciphering "Hale Kannada" characters.

d., probably at Madras, "of apoplexy"; MI. erected by Mackenzie.

BRADLEY, Gregory. Mad. Engrs.
b. 22–8–1780. d. 14–3–09, drowned at sea.

Ens. 19–2–1796; Lieut. 25–8–01.

Son of Robert and Jane Bradley, of London.

1801, survd. marches of Agnew's columns against *poligars* in S. India [123, 382].

BROWN[1], George. Bo. Inf.
b. 1781. d. 17–11–09, Sirūr, 40 m. NE. of Poona.

Lieut. 31–1–1798; Capt. 4–6–07.

Son of George Brown and Mary Barly his wife, of Berwick, NB.

Dec. 1808 to Feb. 1809, Survd. route of Poona Subsy. Force against *pindāris* on N. border of Khāndesh [134]; classed as "valuable" survey by Jopp[2].

BUCHANAN, Francis [I, 315–6]. Ben. Med.
b. 15–2–1762. d. 15–6–29.

Asst. Surg. 1794; Surg. 20–6–07; ret. 14–8–16.

Son of Thomas Buchanan, of Spittal, NB., and Elizabeth, dau. of John Hamilton, his 2nd wife.

FRS.

DNB.; *DIB.*; Buchanan; *Ben P & P.* 1915 (190).

1816, adopted mother's name Hamilton, becoming Buchanan-Hamilton.

1795, with Symes' embassy to Ava [I, 84–5].

1800, spent over a year on svy. of nat. history, agriculture, arts, and commerce, of Mysore, Malabar, and newly acquired territories in south, and pubd. account in 1807 with map, MRIO. 143 (1), compiled and drawn by Crawford[3] [113, 116, 148, 392].

1802–3, attd. to Knox's mission to Nepāl [70–3], making valuable collection of plants and historical and geographical materials, and pubd., Edinburgh 1819, *Account of the Kingdom of Nepal*, with map stretching from the Ravi to Bhutān [73].

1803–4, Surg. to GG., and started menagerie at Barrackpore, the origin of the Alipore zoo.

1805, with Lord Wellesley to England, returning to India 1807.

1807–14, Employed on statistical svy. of Bengal[4], collecting further infn. about the Himālayan regions, which was of great value during Nepāl war of 1814–6 [40, 354–5].

5–4–14, appd. to succeed Dr. Roxburgh [I, 105], as Supdt. Botanical Gardens at Sibpur, but owing to ill-health returned to Scotland the following year.

BUCKE, Nathaniel. Ben. Inf.
bapt. 7–5–1779. d. 8–9–25, Calcutta; MI. S. Park St. cem.

Ens. 6–1–1800 ... Lt Col. 13–5–25.

Son of Nathaniel and Anne Bucke.

Hodson, I (243–4).

21–1 to 20–5–08, survd. route of dett. through Bahraich[5] Dist., and again from 22–7–to 1–8–08 through part of Oudh [27].

Under Dett. Order of 21–11–09, survd. route Nānpāra[6] to "Hyder Ghaut", 21–11–09 to 23–1–10[7].

Burmese War, 1824–5; Arakan.

BURNETT, Thomas Dickason. Mad. Inf.
b. 1787. d. 20–10–11, Jālna; MI.

Lieut. 21–9–04.

Son of Thomas and Elizabeth Burnett of Kensington [I, 364].

Crofton II (120).

April 1805, MMI., cl. I [320]; Dec. 1807, appd. to svy. of Nizām's Dominions 1809–10, survd. route to Sironj [50 n.6]; Dec. 1810, on svy. round Jālna; Feb. 1811, rejoined unit [134].

BYERS, James Broff. Bo. Inf.
b. 21–11–1785. d. 2–9–70.

Ens. 22–5–01 ... Capt. 29–10–16; ret. 18–6–19.

Son of Isaac and Anne Byers.

m., Bombay, 21–3–08, Miss Maria Margoty.

After retirement, to Queen's Coll. Cambridge; ordained Deacon 1819; Priest 1820; 16–1–24, Vicar of Lamphey, co. Pembroke; 17–10–48, Rector of Newchurch, co. Radnor.

June 1804 to Dec. 1805, with Benjamin Sealy, survd. route of Bo. column under Col. Murray through Mālwa and Rājputāna [54, 165], for which, though "not mathematically constructed", he received Rs. 1,000 gratuity, in default of allces[8].

1809–10, asst. under Williams, on svy. of Gujarāt [171–3, 323].

CAMERON, John. Mad. Inf.
b. 1791. d. 15–6–38, Hyderābād; MI.

Son of Capt. Alexander Cameron and Clementina Gordon, of Mortlach, co. Banff.

June 1807, MMI., cl. III [320]; 1810, with Garling on svy. of Kālahasti till 13–4–10 [127], when deputed to Bourbon expn.

1812–3, Asst. Instr. MMI.; 1–11–13, Svy. branch, QMG.'s Dept., 3rd class; MGO. 21–1–15, promoted to 2nd cl.

Marātha War, 1816–8, Fd. AQMG.; 1–9–20, leave to Cape on mc.

CAMPBELL, Robert. Bo. Inf.
bapt. 1–12–1784. d. 3–11–07, Bombay[9]; MI.

Ens. 14–9–04; Lieut. 11–9–06.

Clan Campbell, No. 212.

1807, survd., with Thatcher, "Aurongo & Maun Rivers", and teak forests of Dharmapur & Rajpipla [168]; report, dated Nov. 1807, attd. to Thatcher's map, MRIO. 126 (21).

[1] Map, MRIO. 118 (6) shews him Capt. Browne, Bo. Pioneers. [2] DDn. 235 (20), 3–5–32. [3] Buchanan. I (pref). [4] pubd. posthumously, 1833, by *Gleanings in Science*, and then 1838, as *The History, Antiquities, ... of Eastern India.* ed. by Montgomerie Martin. [5] 63 E. [6] 63 E/5. [7] DDn. 81 (**25, 37**); 82 (29, 31). [8] CD to Bo. 17–1–10. [9] *Oriental Ob.* gives 23–10–07.

CARTWRIGHT, William Perry. Ben. Inf.
b. 1778. d. 24–11–04, Hazāribāgh.

Ens. 23–11–1795 ... Capt. 21–9–04.

Son of Rev. Joseph Cartwright of Dudley and Mary his wife.

m., Frances ——, by whom he left son, Henry; in will, 30–12–03[1], asked wife, then at Hazāribāgh, to proceed, at his death, to his father's house in Worcestershire.

Hodson, I (315).

Between 1801 and 1804, survd. routes from Hazāribagh as far as Surgujah and Sambalpur [44].

CHAVASSE, William. Mad. Inf.
b. 13–8–1784. d. 20–7–14, nr. Baghdād.

Lieut. 21–9–04.

Son of William Chavasse, surg. of Burford, Oxon.

DNB.; *DIB.*; *G M.* 1814, II (498) & 1817, I (379).

April 1805, MMI., cl. I [320]; on svy. of Ryaporam [125]; 1806–7, specially selected for trgn. [126].

Dec. 1807, posted to Lambton's survey; Tranquebar; Pudukkottai; asst. to Bayley, Tanjore to Malabar coast [242, 322].

MGO. 17–11–08, to Bombay for service under Malcolm [131 n.10]; March 1809 to Travancore svy.[2] [132]. April 1810, with expn. to Mauritius, having sold sextant and planetable to Govt. for 35 *ps.*; MGO. 28–7–12, leave from Mauritius to England; submitted to Admiralty suggestions for improving long. obsns. [I, 151].

Made return journey overland, intending to explore route of Greeks described in Xenophon's *Anabasis*; taken prisoner by Kurds, released after payment of ransom. Died on raft on Tigris, just above Baghdad, of "brain fever", and buried on river bank.

CHEAPE, John. Ben. Engrs.
b. 5–10–1792. d. 30–3–75.

Ens. 3–11–09 ... ret. as M Gen. 1857; Gen 6–12–66; Col Comdt. Engrs.

Son of John Cheape, of Rossie, co. Fife, and Elizabeth, his wife.

m., 1st, St. Helena, 5–3–35, Amelia Frances, dau. of Trevor John Chichely Plowden, BCS., widow of George Maxwell Batten, BCS., whom he divorced 1841.

m., 2nd, Agnes Macpherson.

ed. RMA.; KCB. 1849; GCB. 1865.

DNB.; *DIB.*; Thackeray (68); Hodson, I (335–6).

BMC. 22–2–11, reported fit for tr. from Art. to Engrs. comn. being antedated [308]. CE. reports, 9–4–12, that "Ensign John Cheape of the Engineers, employed as assistant under Major Wood at Dum Dum, appears to me...to be steady, and able to conduct a survey on a small scale; his capacity has been tried, and in a few weeks he would learn how to do it on the most extensive one"[3].

BGO. 13–8–14, appd. to svy. Chittagong dist., continuing throughout Nepāl War [19, 178, 311].

Account of later surveys and distinguished mil. career will be given in Vol. III.

CHRISTIE, Charles. Bo. Inf.
b. 1780. d. 31–10–12, kd. at Osbanduz, Persia [*inf*].

Ens. 6–3–1800 ... Capt. 1–2–11.

2nd son of James Christie (1730–1803), 1st auctioneer of firm of Christie & Co. (*DNB.*).

1807, Survd. route to Baroda; "the distance and the route useless"[4].

1809, comdg. escort with Hankey Smith's mission to Sind, and survd. route Hyderābād to Tatta [168–9].

1810, exploration of Baluchistan and Persia under Malcolm, with Henry Pottinger; landed, Jan. 17th, 50 m. NW. of Karāchi, and had adventurous and difficult journey through Baluchistān—disguised as Afghan horse-dealers [7, 174]. Separating after a few weeks, Christie took N. route through Herat, as described by Pottinger;

"His cloaths &c. were of the same description as my own, and...he encountered many difficulties, though they were not of so long duration, from the distance of Herat proving much less than to Kirman. This was, however, quite unexpected, as his Route at the time of our separating was said to be much more perilous and difficult than that by which I travelled; and, though this report afterwards proved incorrect, it does not in the slightest degree lessen the merit of that officer, who selected what he supposed to be the most difficult task for himself"[5].

In forwarding their memoirs and maps later on, Malcolm writes; "The Memoir of Lieutenant Christie, who was entrusted with the execution of this Service, and to whose spirit, firmness, and Judgement, I must chiefly attribute its success, is not so full as that of Lieutenant Pottinger, who acted under his orders. ... The former was, immediately on his return, detached to Tabreez. ... As the route which they both travelled from Sommeeanah to Noosky[6], is laid down by Lieutenant Pottinger, I did not think it necessary to include it in the copy of Lieutenant Christie's route"[7] [339].

On Malcolm's return to India, Christie was left on deputation as instructor with the Persion army, and was kd. in a frontier skirmish with Russian troops, which had arisen through a misunderstanding. He "fell a victim to the very embarrassed situation in which himself and the other British Officers were placed, during a Surprize on the morning of the 31st October, and attack early in the morning of 1st Inst. on the [Persian] Prince Royal's Camp at Osbanduz, by a Russian force under the Command of General Kottoreski"[8].

CLIFFE, John. Bo. Engrs.
d. Carlisle, 14–4–21.

Ens. 17–3–1783 ... Maj. 27–2–27; ret. 1807.

Conolly 103 (21).

MRIO. 93 (12) delightful little svy. of Perim I., Red Sea, 1,000 yds. to inch, 26–6–1799.

CLODE, Thomas. Mad. Inf.
b. 1786. d. 28–6–12, at Banka I., off SE. Sumatra.

Lieut. 10–9–05.

Son of George and Sarah Clode, of Berkshire.

ed. Eton, 1799–1802.

April 1806, MMI., cl. II [320]; 1807, MRO. Map 42, map of Karanguli[9], by Clode and Harris; 1810, in ch. tank repairs during absence of C. C. Johnston, survd. part of E. Ghāts near "Palamanair", N. Arcot[10] [404]. Jan. 1811, to rejoin unit.

1812, Asst. Sec. to Govt. of Java; d. of fever while acting as Engr. on expn. to Sumatra [320].

[1] Ben. Wills, 1805. [2] Map of Trichur, (58 B/2), 1809. MRO. Map 401. [3] DDn. 126 (134). [4] DDn. 278 (162). [5] B Pol C. 25–6–12 (9). [6] Sonmiani, 35 K/11; Nushki, 34 K/2. [7] B Pol C. 2–6–11 (7–9); cf. Murray, II (516–25); Davis (18–9). [8] BSC. 1–10–13 (69). [9] 57 P/14. [10] MRO. Map 266.

COLEBROOKE, Henry Thomas. BCS.
b. 15–6–1765. d. 10–3–37.

Writer, 1780/1[1] ... Supreme Council, 1807; ret. 27–12–14.

2nd son of Sir George Colebrooke, 2nd Bart.; banker; Chairman, EIC., 1769, 1771 [I, 326].

1st cousin to Robert Hyde & James [*inf*].

m., 2–7–10, Elizabeth, dau. of Johnson Williamson of Portman Sq.

Bio. by his son, Sir T. E. Colebrooke (1813–90); marble bust, RASB. Calcutta, by Chantry, 1820.

FRS.; *DNB.*; *DIB.*

1782, arrd. India; 1789–93, Asst. to Collr. at Purnea, making the first obsns. to Himālayan peaks from the plains to determine height [I, 77].

1798–1801; journal of mission to Nāgpur[2].

1807–14, Presdt. of ASB.; Sanscrit scholar; 1826, one of the founders of R As Soc., London.

Took keen interest in Himālaya Mountains, encouraging and helping all attempts at svy. and exploration. After retirement pubd. important papers; *On the Sources of the Ganges*: ... [6, 76–7]; *On the Height of the Himalaya Mountains* [87–8]; *Variation in the Snow-line*[3].

DDn. 156 (151), Mackenzie writes to Webb, 16–3–19; "The enclosed Paper on the Himalaya Mountains which has appeared under the initials of H.T.C. in the Journal of Sciences & Arts for August... is printed in the Calcutta Journal for last Sunday, & I understand the Table of Heights and Positions was omitted only for want of a Type for such a number of figures. This is a pity as it would have been desirable to many. ...

"I take it for granted that the initials are those of our friend Mr. Colebrooke. ... You could not have an abler expounder, or more zealous defender of your labours. I have not heard from him this season, but I understand he is much engaged in Geological pursuits, & is a leading member of that Society".

After retirement became totally blind.

COLEBROOKE, James. Mad. Inf.
b. 1772/3. d. 18–1–16, Madras; MI. St. Mary's cem.

Lieut. 1–4–1793 ... Capt. 7–5–1800 ... Lt Col. 1814/5

Bro. to Robert Hyde [*inf*] and 1st cousin to Henry Thos. [*sup*]. His younger bro. John, Mad. Cav., accd. Malcolm to Persia, 1800 [173].

CB. 1816.

MMC. 8–10–1799, appd. Capt. of Guides; 1800, survd. Wellesley's marches in pursuit of Dhoondiah on and beyond NW. frontiers of Mysore; very neat and artistic, MRIO. Misc. 1–0–08 [122]; 1801, Jan. to March, survd. route of Stevenson's column thro' Wynād into Kottayam[4] [123]; Sept. to Nov., minor trgn. and svy. of roads with Lambton in Mysore [94, 100, 118].

1802, survd. district of "Bullum", in W. Mysore [pl. 11]; 1803, survd. marches of Nizam's Subsy. Force under Wellesley, classed as "valuable" by Jopp in 1830[5].

1–10–13, appd. Dep. JAG. Madras.

COLEBROOKE, Robert Hyde [I, 326–9]. Ben. Inf.
b. 1762/3. d. 21–2–08, Bhāgalpur.

Lieut. 9–11–1778 ... Lt Col. 2–11–03.
SG. Bengal, 1794–1808.

Eldest nat. son, by Mary, wife of Robert Jones, of Rbt. Colebrooke, of Chilham Castle, Kent, HM. Minister to the Swiss Cantons, 1762–4.

1st cousin to Henry Thos. [*sup*] and bro. to James [*sup*]; "near relation" to John Garstin [qv., 391].

m., Calcutta, 31–7–1795, Charlotte dau. of John Bristow [I (168)], who survived him with 9 children—Mary Anne Louisa, b. 1796—Elizabeth, b. 1798—Frances Henrietta, b. 1798/9 who m. Calcutta, 1–5–19, Joseph Taylor[6] (1790–1835), Ben. Engrs.—Emma Sophia, b. 1799, who m. 20–12–20, Wm. Colebrooke [*inf*]—Richard, b. 1800, Ben. Inf.—youngest dau., Julia Louisa, m., Wallajābād, Thos. Ryves (1805–75), Mad. Inf., survr.

Miniature in possession of Taylor family [391, pl. 19].

Hodson, I (361); III (758).

1781–5, with Ben. dett. under Pearse to Madras, survg. return route along coast [I, 41–2]; 1787, asst. to Kyd. on svy. Penang [I, 46–7]; 1789, asst. to SG. for office duties [I, 237]; 1789–90, asst. with Kyd on svy. Andaman & Nicobar Is. [I, 48–9].

1791–92, 2nd Mysore War, survg. marches of army under Cornwallis [I, 112–3]; 1793, held ch. of SG.'s Dept. during absence of Kyd, succeeding as SG. 7–2–1794 [I, 261]; 1794–5, survd. channels between Ganges and Hooghly [pl. 19 a]; 1796–7 survd. Ganges from Jalangi to Colgong [I, 63–5][7].

15–8–01, leaving office under ch. of Blunt, accd. GG. from Calcutta; extended svy. of Ganges from Colgong to Patna, arriving 6–10–01. Leaving GG.'s fleet, survd. Ganges up to Allahābād before return to Calcutta [21–2].

1802–7, employed at Calcutta as SG., compiling and drawing maps with no other assts. than three or four dmn.; one of these was a new Map of India which he was never able to finish [4, 58, 123, 134]. He writes in 1804 that he found "his own personal exertions...unequal to the quantity of work in hand", and concludes; "Excuse this scrawl as I write by candle light, and my eyes are beginning to fail me" [33, 117][8].

Though too busy to keep up the astr. obsns. he had started at SGO. [I, 168; II, 191], he maintained keen interest, and corresponded with Goldingham and Warren about longitudes of Calcutta and Madras [I, 180–1; II, 190 n.1, 195].

He fully appreciated value of Lambton's work, and in 1800 had been member of com. which inspected the insts. bought from Dinwiddie [252, 383]. In 1806 he wrote to Warren, "I have not heard for a long time what progress Major Lambton has made in his survey of the Peninsula. It is a pity that a survey conducted on scientific principles is not extended all over India, as far as we have free access to go"[9].

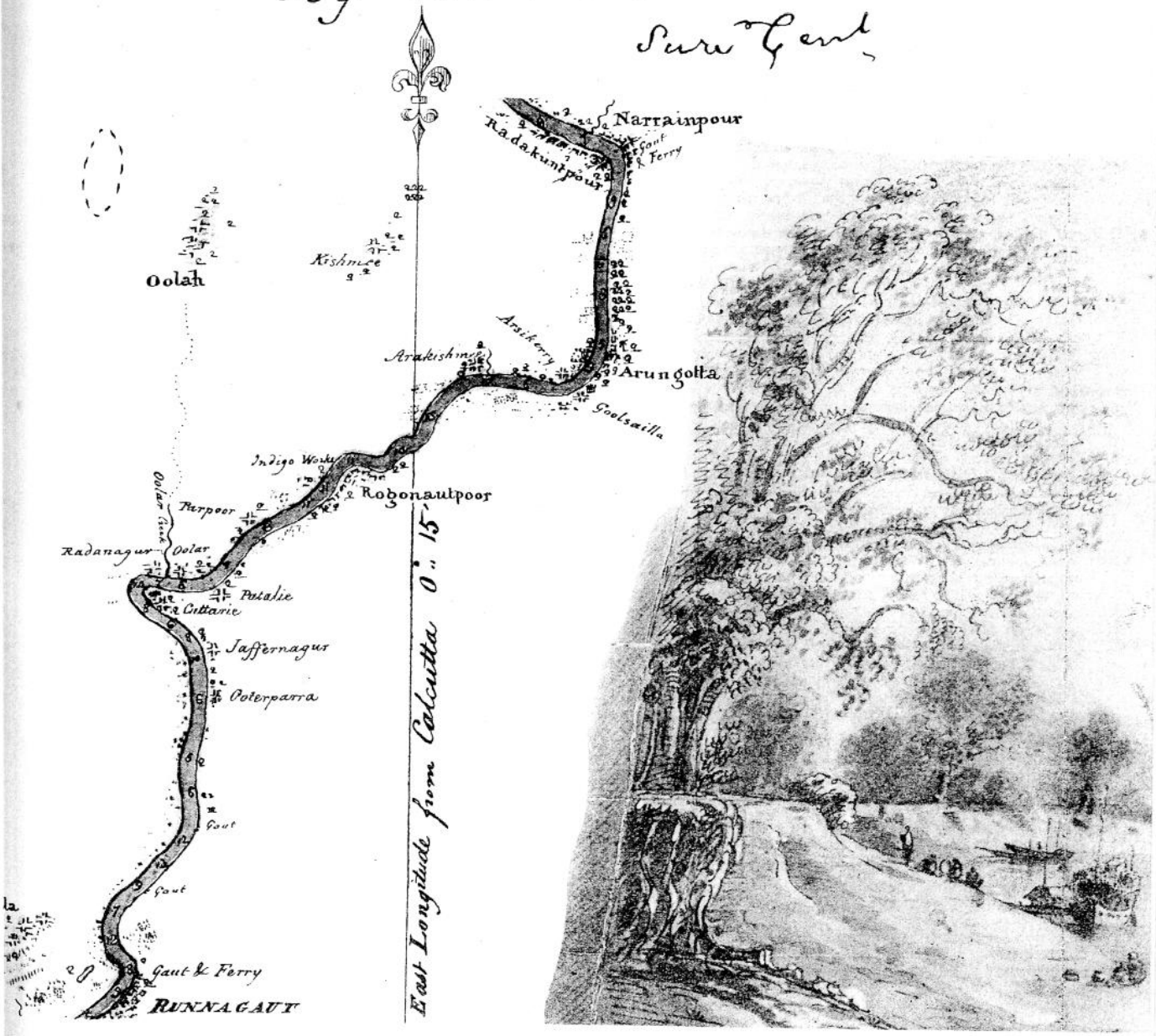
[1] *EIC. List of Factors*, gives 1780. [2] BM Addl MS. 13588 (1). [3] *As R.* XI (437–45); XII (25–3 *et seq*). [4] 49 M/9, 13. [5] DDn. 235 (20), 3–5–32. [6] whose grt.-gr.-son Rbt. Hyde Colebrooke Taylor, b. c. 1927, was studying survey, London, 1946. [7] Full particulars before 1800 given in Vol. I. [8] to Crawford, DDn. 67 (489) 15–6–04. [9] DDn. 47 (29), 18–12–06.

SURVEY
of the
CHOORNEE
or
HURDUM RIVER

taken in February 1795

By R H Colebrooke

Surv Genl



Reproduced from Colebrooke's original map, M.R.I.O. 167 (2).

He intended to have accd. his wife to England in 1805, but withdrew appn.; she went without him, taking two *ayahs* with the children[1], but returned in time to travel up country with him in 1807, and he makes several references to her or the children until they reached Lucknow, Dec. 21st [31, 389].

1807, after urging for some time the importance of a svy. of "the Ceded and Conquered Provinces" [28–9, 60], he left Calcutta, 14–4–07, to undertake the svy. himself, travelling by way of the Sundarbans and Dacca [22–3]. He took a couple of dmn. and a clerk with him, but left the maps and routine duties under ch. of John Garstin [296, 401].

Extracts have already been given from his letters and journals, [29–33, 37], but his obsns. on the people and sights of the country are of such interest that it is a pity to leave them for ever buried away; his journals were often writen in pencil, most untidy, and full of corrections, probably made with a view to be fair copied or pubd. later.

They are mixed up with his traverses of rivers and cross-country routes, and, besides frequent rough sketches of the route, often contain clever pencil sketches of boatmen or scenery[2].

He starts with an account[3] of a week-end visit paid to William Carey's mission at Serampore[4]; "1807. Saturday March 27th, at 10 A.M. Embarked on board my pinnace at Baloo Ghaut below Fort William, and went up with the Flood Tide to Serampoor, with the intention of seeing the Hindoo and Mohammedan converts, and of conversing with the Missionaries at that place".

He comments on the scenery along the banks of the Hooghly, and certain horrible local customs, and continues; "At 3 o'clock anchored just below Sirampoor. The afternoon was extremely hot and the Thermometer...must have been considerably over 90°. ... In the evening I went ashore and waited upon the Reverend Mr. Carey, a missionary belonging to the Society of Baptists, who with five others of the same fraternity resides at this place.

"After drinking tea, I attended their family worship, which began with a great seeming devotion by the whole congregation, which consisted of themselves, their wives and children, and a school which they keep. ... At this meeting were present about ten of their Hindoo converts. ... The assembly broke up at 9, when I retired to my Boat to rest, highly gratified with this novel and interesting scene.

"April 14th. Being deputed by the Governor General in Council on a survey of the Ceded and Conquered Provinces in Upper Hindoostan, I left Calcutta at 5 p.m., and arrived a little after sunset at my boats which I had previously sent on to Garahaut. This village is situated on the northern bank of Tolly's Canal [I, 65], about midway between the Hooghly River and the Sundarbans[5]. ...

"23rd. At 2½ in the morning began rowing down the river. ... At 6½ we were opposite...an Indigo Work. Took a walk on shore and saw many curlews, paddy birds, and a few snipes. Just below this place they were burning the body of a Hindoo close on the margin of the water. ...

"At 4½ p.m. we came to near a village called Baggah. ... There a vast concourse of people were assembled and held a fair or weekly market, which we visited in the evening. The only commodities exposed for sale consisted of coarse cloth, rice, tobacco, ... etc., and the only money which I saw circulated was cowries, though some rupees must have been exchanged for the cloths.

"The people flocked round me and my young lady and her children[6] as if we had been wild beasts. Certain it is that in this district, few can have seen the face of an European for I observed a degree of wonder in their countenances which was unusual[7]".

Then follows a chatty account of the journey through the Sundarbans, interspersed with tiger stories; "May 10th. Set off at ½ past 5 o'clock and walked about two miles on shore before breakfast. ... A little way further the river appeared to have made considerable encroachments upon one of the villages, and the bank was covered with trees and bamboos which appeared to have been recently undermined and fallen partly into the river. The breadth of the river appeared to be much greater than it is represented in Major Rennell's maps and in other respects I could trace no resemblance. ... One village in particular, viz. Pialapoor, which appears in the Bengal Atlas [I, 227–30] to have been a place of some importance, I looked for in vain, and I was informed that it had been swept away by the river. Besides Gwalpara, I only found one place in twenty miles that corresponded with Major Rennell's map, and that in the name only, for it was inserted on the wrong side of the river, but this might have been owing to the removal of the village from one side to the other, as is frequently done in consequence of the encroachments of the river, and not to any mistake of the surveyor" [I, 64].

Stayed 12 days at Dacca; exchanged visits with Nawāb, and left May 28th.

"June 9th. This morning before the boats got under way I took a walk with my gun, but the ground being wet from the rain I did not proceed very far. I started, however, a few brace of quails and a hare, but the lock of my gun being out of order it missed fire as often as I drew the trigger. I saw likewise some wild ducks, two of which were shot by the manjee of my boats. ... Having surveyed this part of the Ganges in the year 1797 [I, 329] I was astonished to observe the alterations in the formation of sand which had taken place. The main stream...had receded to a considerable distance and left only a navigable creek which in one place was scarcely deep enough for my pinnace. Several islands raised considerably above the surface of the water, upon which cattle graze and corn is sown, now occupy the space which was formerly filled by the principal stream of the river, where the current ran with immense velocity, and the water was in some parts at least 30 feet deep".

June 10th, reached Bagwangola[8], above Murshidabad; 18th, Colgong, and 21st Monghyr. 23rd, visited the hot springs at Sitakhund, four m. below Monghyr [390], and captured an alligator; "I did not reach my boats until near 11 o'clock, when a comfortable breakfast refreshed me after the morning excursion. In the afternoon they bought me word that the alligator was dead. They had kept it under water tied to the boat's stern, whereas they should have kept it in a cool place above water, and plunged it occasionally into the stream or have bathed it with buckets of water as they do Turtle at sea [I, 327–8]. I really entertained hopes at first of preserving this Aligator alive, at least for some time. ... The bugs and insects proved so troublesome in the evening as to force me to retire to rest sooner than I should otherwise have done. Sky clear but weather close. ...

"July 14th. The air became so cool this morning (Thermr. 81°) as to oblige me to pull a sheet over me before I got up. At half past 5 o'clock, having taken another look at the Great Banyan Tree, and a sketch of it, I set sail and proceeded 9 miles up the Goggra [29]"[9]. ...

"15th. ... We passed several villages, at one of which called Fulwary many boats were building from the timber of the Gorauckpoor Forests [I, 333]. ... After sailing about 18 miles we brought

[1] BPC. 24–12–06 (29). [2] DDn. 73–5, 80. [3] DDn. 79. [4] Founded Baptist mission in India, 1793. [5] DDn. 79. [6] Charlotte, if 18 at marriage, would now be 30; Mary 11, and Elizabeth 9; there was also a nurse [389]. [7] DDn. 75. [8] 78 D/7. [9] joins Ganges at Chapra, 72 C/9.

to at the village of Nurhan on the N. side of the River at half past 11 o'clock. I stopped there early to wait for one of my native assistants, who was measuring the road with a perambulator on shore [31]. ... Saw this day several Pelicans, the first I had seen for a considerable time, as they are not commonly met with in the Ganges higher than the Sooty.

"At Eyaspoor which we passed this morning there is an old Fort...from the top of which I took some bearings. ... The numerous Forts...in Hindoostan served only formerly to keep the country in a perpetual state of warfare—rebellion. No sooner did a zemindar find himself in arrears in the payment of his Kists than he armed himself and his followers to defend what he was so unwilling to pay, and the contest which ensued was frequently desperate and bloody, though in the end the rebel was usually obliged to yield to superior force [I, 133, 291].

Colebrooke took his svy. up the Gogra, and then up the Rapti beyond Gorakhpur, making his first obsns. of the Himālayan peaks [6, 86–7]; July 27th. "In the afternoon the snowy mountains being visible, I took some bearings of them with a Ramsden's theodolite. ... The station where I took these bearings was 3 furlongs west of Goruckpoor Fort, the opposite side of the river. ... August 6th. At Gorrackpoor ; obsns. to a high double peak of snowy mountains".

On 10th, he re-entered the Gogra, and reached Fyzābād ; "August 22nd. We reached the principal ghaut or ferry of the Goggra between the city of Oudh[1] and the province of Gorrackpoor[2]. ... The city of Oudh standing on a projecting point of the Goggra, we fairly sailed round three sides of it, and at 41 minutes past one o'clock arrived as near to Fyzābād as the river would allow, no part of that city being nearer than about a mile from the river. ...

"30th. This day we passed the worst part of the Goggra River we had hitherto met with.

"31st. We were detained this morning for one of the boats which had not passed the quicksands until 9 o'clock. As the day broke I could very distinctly hear the drums at Bhowrigunge, a military station belonging to the Nawab, about three miles on the north side of the river, and Serora[3] which is occupied by our troops.

"There are only five companies stationed there and five more at Byramghaut. The former station for the troops in this part of the Nawab's country was Beraj, or Beraitch[4], but it was found that the vicinity of the hills and jungles rendered it extremely unhealthy".

The survey was taken 60 m. above Bahrāmghāt till the boats could go no further and the men grew scared of the dense forests. On return Colebrooke turned up the Sarju R. for a few days, and then back to Oudh, Sept. 28th, and reached the Ganges once more, Oct. 10th, having an exciting time getting through the shoals at mouth of Gogra ;

"As we had anchored in a creek formed by a projecting point and an Island on our right, we had some little difficulty in getting out into the open stream, the wind blowing us against the point ; and as the men were not very active, ... we struck upon a Conkis[5] Shoal, and the boat immediately healed over as she had done the evening before [*sic*].

"The stern happening to lie close to the bank, I jumped on shore with my two children [387 n.6], while they righted the boat, and by dint of great exertion got her off the shoal. ... Having cleared the point we sailed with wind and current in our favour at the rate of about 6 miles per hour, and had every prospect of reaching the mouth of the Goggra near Manjee before noon.

We had yet however to encounter the quick sands, and... about 18 miles from the place we had left in the morning we suddenly took the ground and healed over as usual on one side. I observed that it was a very extensive flat, though not so dangerous a one as we had been on the evening before. It took us however an hour and a half to clear it, which was in fact by the boat cutting her way through the quick sand.

"It was curious to observe the effect of the water and sand bubbling up together from under the boat's bottom, and the Dandies pushing down the sand with their feet. As often as the boat lay with her broad side to the stream and consequently healed over, a whirlpool immediately formed on the other side, which seemed to threaten to swallow her up. I can readily believe that a crazy Bazerow or a sharp built Pinnace might easily have been, though I did not give much credit to this report until I had myself seen these terrible quick sands [I, 26–7].

"Having got clear of the quicksands we proceeded as rapidly as before and, taking care to keep in the channel, we fortunately arrived at the mouth of the Goggra and brought to near the point of confluence at half an hour past one o'clock. The Goggra when it joins the Ganges is about half a mile across, running at this season in one stream which is tolerably free from sands and shallows".

Colebrooke now continued up the Ganges, stopping at Buxar and then at Ghāzipur ; "It was here that Marquis Cornwallis died on his way up the country in October 1805. This illustrious nobleman had only recently arrived, for the second time, in Bengal ; when, being anxious to put a stop to the war we were then engaged in with the Mahrattas, had embarked at Calcutta soon after his arrival, ... and proceeded with all expedition up the river. [His] constitution...was not proof against the sultry climate of Bengal and Bihar at the close of the rainy season, added to which the noble marquis was in the decline of life when he accepted for the last time the important and highly laborious office of Governer General of India. His Lordship began to be seriously indisposed soon after quitting the Presidency and continued in a declining state until he reached this place. ... I went on shore to visit the tomb which stands about 300 yards distance from the bank of the river [31 n.1 pl. 18]".

Reaching Benares Oct. 23rd, he found "the water in Goomtee River too shallow to traverse", so continued up the Ganges.

"November 17th. Went out in the morning to look for Game, but with the exception of one Hare which I started met with nothing but some pigeons and doves. In the meantime my Boats went on and I met them about two miles from where they set out. ...

"18th. As my Servants were moving a trunk in my cabin this morning, they found a snake about 18 inches long which they killed. It had probably got in at the windows during the night, and the cold had no doubt contributed to drive the reptile to seek shelter in my Boat. It is no uncommon occurrence, however, for snakes to swim off from the shore and to get on board of Boats at any time of the year. If in the day time, they are usually seen and driven off with Bamboos before they can climb the side of the boat or the Rudder, which latter is the part they usually attempt to get up by. ...

"There had been a very heavy dew, and on walking on shore through the jungle, my feet and legs were in a few

[1] or Ajodhya, 3 m. E. of Fyzābād. [2] which then included the present district of Basti. [3] Sacrora, from 1802 called Colonelganj, 63 E/12 ; *Imp Gaz.* X (375). [4] Bahraich, 63 E/10. [5] *kankar*, granulated limestone.

minutes as wet as if I had waded through a Pond. I saw three antelopes and put up some quail, but shot only a Teal and a Curlew. The wind getting up from the west again impeded our progress, and by five in the afternoon we had not advanced above eight miles".

Reaching Cawnpore on Nov. 30th, Colebrooke paid off his boats, and halted a fortnight preparing for his land journey to Rohilkhand. At his particular request William Webb was posted to command his escort [31 n.3], and with family and all he set out for Lucknow. "My travelling equipage now consisted of 4 elephants which carried two markees and 6 private tents ; five camels for my baggage ; a palanqueen, a mahana and dooly, the latter two carrying my two children and their nurse[1], 12 bhangies[2], 12 coolies, 12 lascars for pitching the tents, and an escort of 50 sepoys'.

They stayed at Lucknow with the Resdt. from Dec. 21st till Jan. 1st ; "Dec. 22nd. Rode into the lines. The Nawaub paid a visit of ceremony to the Resident, to congratulate him on his recovery. Went to see the house and villa of the late Maj. General Martine at Constantia, which is unique of its kind[3] [I, 354].

"23rd. Paid a visit to Col. Gregory[4], & returned to town with him on his elephant.

24th. Paid the Nawaub a visit at Breakfast in company with the Resident, and afterwards went to view his stud, which for the number and beauty of the horses is probably one of the finest in the world".

Colebrooke appears to have left his family at Lucknow, for we hear nothing further of them, and he obtained an increased escort as protection against gangs of robbers said to lie near the N. frontier, and engaged Hearsey with sowars to add protection to his party [359]. From Bareilly he moved up to foot of the hills to the point where the Sarju, or Sarda, breaks out [31–2].

"January 30th [1808]. Rain. The Kumaon hills were now partly covered with the snow that had fallen in the night, and appeared to be still falling on some of their summits. With a glass I could plainly distinguish the fir trees and snow intermixed, as the distance of the middle range where the snow had fallen did not exceed thirty miles. Their appearance was very different from the furthest or uppermost range upon which snow is seen all the year round"[5] [84–5].

Working along the foot of the hills to Kāshīpur [pl. 3], meeting swamps and forests, Colebrooke picked up an intermittent fever, and had to leave the svy. to Webb for several days. After a short rest he reached Morādābād Feb. 17th, and was delighted to be able to get more obsns. to snowy peaks. Leaving Webb to continue the svy. of Rohilkhand, he went on by himself through Meerut to reach Delhi March 16th.

He was now feeling so poorly that he decided that he could not carry out his long cherished scheme of exploring the Ganges above Hardwār, and he asked Govt. to let him send Webb instead. This being sanctioned, he made preliminary arrangements with the chief at Srinagar through the agency of the Resdt. at Delhi, and Webb was able to start from Hardwār early in April [74].

During his visit to Delhi Colebrooke stayed with the Resdt. who writes to Govt. ; "In conformity to ancient Custom the Nou-roze Festival was celebrated on the 21st March, when His Majesty, seated in state on the peacock throne[6], received the usual Nuzzers of congratulation. ... Lt. Col. Colebrooke, Surveyor General, having lately visited this City in the course of public duty, & having had occasion to inspect the town, the Course of the Canal &c., in a manner which attracted observation, I deemed it necessary to explain to the King the Nature of Colonel Colebrooke's situation and, as I found that his being presented to His Majesty would be gratifying, I deemed it an attention due to the King's wishes to propose it to the Surveyor General, who was accordingly introduced on the 29th March ; on which occasion he presented the Nuzzars usually offered by Officers of his rank, and received a Dress. Considering the circumstances of the Case, I felt it to be incumbent upon me to defray the amount, viz. 9 Gold Mohurs[7], out of the Public Treasury, which I trust will not be disapproved of by Government". Colebrooke had to present a further *nazar* "of 2 Gold Mohurs to the Nawaub Mumtaz Mehal", which was also charged to the treasury[8].

His fdbk. contains obsns. from top of the Qutb Minār [I, 314] with copy of an "Inscription over a Gateway of three arches at Mehldar Khan Kutb" and of "a Persian Inscription taken from the Jummah Musjid"[9].

About this time he got into trouble with the General Officer at Meerut ; "Major General Dickens[10]...has thought proper to charge me with great disrespect for not having reported to him my arrival within the limits of his Command, and for not taking the least notice of him as the General Officer Commanding the Field Army. ...

"First.—For not reporting my arrival—I did not at first consider it as necessary to do so because, as Surveyor General, and acting under the immediate orders of the Governor General in Council, I could not suppose myself to be under the Command or controul of Major General Dickens.

"Secondly—For not having taken the smallest notice of the General Officer Commanding—To this charge I have only to reply that Major General Dickens not having, previous to the date of his letter, been present at any of the stations I passed, I could not have had the opportunity of personally paying him that respect and attention which are due to his high Rank, and which I have never omitted on passing any Military Station, even where the Officers in Command have been greatly my juniors in the Service.

"On my arrival at Meerut, where General Dickens happened to be on the 5th of last month, I was informed...that he had mentioned my not having reported myself to him, in consequence of which I immediately wrote him a Letter reporting my arrival, ... and apologising for not having done so before, as well as for not being able to wait upon him at that time, in consequence of severe indisposition. To this General Dickens was pleased to return a polite answer stating that he had received Orders from the Commander-in-Chief to reinforce my escort, and desiring to waive the ceremony of waiting upon him the next day as I had proposed to do"[11].

He now moved down to Bareilly where he arrived 17–4–08, and occupied himself protracting his svys. and working up his maps, and taking further obsns. to snowy peaks while waiting for Webb's return. Webb arrd. at the end of June after an adventurous journey [75–6], and, a month later, Aug. 1st, Colebrooke set out from Bareilly by boat down the Rāmganga, making surveys as he went. On the 10th he turned up the Dewah and survd. four days up to Pāli[12].

Aug. 15th. A squall with rain came on at 2 o'clock in the morning. but the weather cleared up before 3, at which time, it being moonlight, we got under way. ... Hearing some firing, which on enquiry proved to be nothing more

[1] Did he and Charlotte share the palankeen [387 n.6] ? [2] porters. [3] cf. Hastings' *Journal* (106). [4] R. B. Gregory d. 1824 ; Ben. Inf. ; Hodson, II (333–4). [5] Journal, DDn. 80. [6] Akbar II succd. Shāh Alam 1806. [7] 16 rupees to one gold *mohur*. [8] B Pol C. 25–4–08 (45) & 2–5–08 (38). cf. Reynolds' presentation at Delhi in 1794 [I, 301–2]. [9] DDn. 73. [10] M Gen. Richard Mark Dickens ; d. Muttra 29–4–08 ; *OW*. I (266). [11] BMC. 25–4–08 (69). [12] Deona or Garra R. meets Rāmganga 54 M/16. Pāli, 54 M/14, 25 m. S. of Shāhjahanpur.

than the people in a neighbouring village discharging their muskets to celebrate the birth of a child. ...

"Soon after we met a party of the Nawaub's Sepoys. ... They had been detached in pursuit of a rebel zemindar who had lately committed some depredations and plundered some boats on the River, but had eluded their pursuit and fled to the Jungle, there to add to the number of Banditti who continually infest the Nawaub's Territories[1], particularly near the Boundaries.

"16th. Set off at 5. ... The wind was so violent from the East that we were at times wind-bound and unable to proceed ; at others...we sailed with only Jib & mizen at a prodigious rate. We were soon brought up however by some sharp point when the River turned again, and obliged to use the track ropes to avoid being driven on the opposite bank. ...

"17th. Set off at Daylight &...at 7 reached the outlet of Gurrah (or Dewah) River. ... Below this the united streams... form the Gumberah, which disembogues in the Ganges at Neerah Ghaut[2]. Its breadth increases gradually from one and half furlongs to three furlongs, but its whole course does not exceed eight miles. We entered the Ganges accordingly at half an hour past one, having drifted but slowly with the current owing to a strong S.Ely. wind. On entering the great River, which was very high and the current rapid, our progress was somewhat accelerated. ... At 6 o'clock we arrived at Mandy Ghaut, and brought to at the outlet of the Calinai, or Calu Nudee, River[3]. ...

"18th. ... Tracked a little way up the Calinuddee to see the ruins of Kanouge[4], of which there are now few remains. At the same time I walked on shore, but did not go far enough to gratify my curiosity, as the morning [was] now growing warm, and I was moreover very weak from the effects of a Dysentry. ...

"At 9 o'clock we returned and reached the Ganges before 10, but we had not proceeded far before we were thrown up on a Quick Sand, from which we did not extricate ourselves until half an hour past one [388]. ... The current being rapid and the weather calm, we dropped down at a great rate after clearing the Shoal, ... and at half an hour past five brought to on the left side of the River. ... There the River had partly overflowed the banks, but a slip of firm ground covered with green turf afforded our people ample room to cook their victuals, and the Sheep and Goats to graze.

"19th. ... At ½ past 9 o'clock passed Betoor[5] on our right, a very ancient city, and full of Temples and brick Buildings. ... The place is I believe famous in the annals of the Hindoos, and Capt. Wilford [I, 396–7]...mentions it as the occasional residence of the Patriarch Noah. If so, it must have been founded by him. It is remarkable that this place and Adjudia or Oud [30], where the Tomb of the Patriarch is shewn, are the only two places in Hindoostan where the Patriarch is supposed to have resided. That in the decline of life the aged and holy Patriarch should have travelled to Hindoostan is not improbable, as the heat of the climate might have been more congenial to his health & constitution than the mountains of Armenia ; but he might have had another and more important motive for doing so, which would have been to mark the progress which was made by his children and descendants in peopling the earth and building Cities. His authority among them would have been little less than that of a Sovereign Prince, and as he survived the flood three hundred years, he might easily have lived to see the extensive regions of the upper Hindoostan, as well those of Persia, Armenia, and the Punjab, which he had left behind him, in a tolerable state of population and improvement before his death".

Colebrooke arrd. at Cawnpore 19–8–08 [33], and on 26th wrote to Webb, "As my complaint has become much worse since I came here, I have determined to leave Cawnpore the day after tomorrow, being convinced that the River air is less unfavourable for my disorder than that of the Cantonments. ... It is most likely I shall take my passage for Europe this year"[6].

On the 28th he starts his journal again ; "Having stayed at Cawnpore since the 19th very ill of a Dysentry, I took my departure from it this morning, a little sooner than I had intended, being persuaded that the Air of the River was more likely to bring about a favourable turn in my complaint than all the drugs which had been prescribed to me at that place. Set off at 8.

"30th. ... Very ill today of the Dysentry. ...

"Sept. 3rd. ... Passed Mirzapoor at 7 o'clock & soon after met the Fleet of General Hewett, Commander-in-Chief [298], proceeding to the Upper Provinces. ...

"5th. Set off at 4 in the morning. ... Cantonments of Ghazipoor, where we arrived...about noon. ... At 2 p.m. left Ghazypoor, and after drifting about 10 miles against a strong Easterly wind, which raised a high sea and agitated the boat a good deal, we brought to. ... The Pinnace sprung a leak this day, which rendered it necessary to keep some hands bailing out the water during the greater part of the night. ...

"7th. Having stopped the leak we had sprung during the boisterous weather of yesterday and the day before, at 11 o'clock we got under way. ... We experienced as hot an afternoon as I remember. At 6 p.m. brought to...about 30 miles by water from Buxar. ...

"8th. Set off at ½ past 5. ... At 10 p.m. passed the Mouth of the Goggra, which River I surveyed last year [29–30] [to] 300 miles from its outlet, and whose issue from the Mountains at Burrumdeo[7] I visited in January last [26, 32, 389]. At 11½ passed Chupra, and at half past 3 the Cantonments of Dinapoor. At 5¼ p.m. brought to at Mr. Wilton's Ghaut at Bankipoor[8]. The day proved excessively hot. ...

9th. After a very hot and sultry night we left Patna at Sunrise. ... A violent squall with rain from the N.W. came on and obliged us to bring to, distance from Patna about 53 miles.

10th. Strong Easterly wind and cloudy weather, with occasional showers of rain. Set off at 6, & drifted with the current, setting at the same time the sails and tacking across the channel. ... In the evening at 6 brought to... 3 miles above the Fort at Mongheer. ...

12th. Rainy morning, with long continued peals of thunder & lightening before daylight. Therm. at 6, 81°. Set off at 8, and at a ¼ before 10 a.m. brought to for a little while opposite to the Seetacoon well [387]...to fill a jar of water from the well. The Bramins soon found me out, and came running down to the Boat to beg as usual. After filling the jar, I gave them a rupee to divide amongst them, with which however they did not seem to be well satisfied, as some of them continued murmuring and asking alms until the Boats were under way.

"We continued drifting but slowly during the remainder of the day, which proved extremely cloudy, with every appearance of an approaching storm, and at 6 p.m. arrived opposite the Junguiree Rocks[9], where we brought to for the night.

"13th. The weather was so bad as to oblige us to lay to all day at Jungeera. Rainy and Stormy night.

"14th. ——"[10].

The journal breaks off here, though a page may have dropped out, and Colebrooke would have reached Bhāgalpur this day, September 14th, the final stage of his journeyings.

[illegible]

[1] Oudh. [2] now meets Ganges opposite Kanauj. [3] no traverse kept down the Ganges. [4] Kanauj, on the Kāli N. which joins *right* bank of Ganges, 54 M/16. [5] Bithūr, 63 B/6, 12 m. above Cawnpore. [6] DDn. 82 (50). [7] Baramdeo, 62 C/4. [8] John Wilton (*c.* 1756–1835) ; BCS. 1776. [9] Rocky island at Sultānganj 72 K/12 ; *Imp Gaz.* XIII (78). [10] DDn. 73.



R H Colebrooke
Surv.r Genl

ROBERT HYDE COLEBROOKE
1762/3-1808.

OF BENGAL INFANTRY. SURVEYOR GENERAL BENGAL, FEBRUARY 1794 TILL DEATH, SEPTEMBER 1808 [I, 261; II, 295].

Had long career as surveyor, leaving delightful journals and sketches [**I,** 48–9, 326–9; II, 29–33, 387–90, pl. 19 A].

FROM A MINIATURE IN POSSESSION OF JOSEPH TAYLOR'S FAMILY.



A. Kyd

ALEXANDER KYD
1754–1826.

OF BENGAL ENGINEERS. SURVEYOR GENERAL BENGAL, NOVEMBER 1788 TO FEBRUARY 1794. FIRST SUPERINTENDENT ANDAMAN ISLANDS, 1792-6. CHIEF ENGINEER, 1807–10 (1, 345–7).

FROM A MINIATURE BY JOHN SMART, MADRAS, 1791–2; BY PERMISSION OF SPINK AND SON, ST. JAMES' STREET.



John GARSTIN (1756–1820)

Of Bengal Engineers. Surveyor General of Bengal, September 1808 to April 1813, holding office as Chief Engineer at the same time [295], and continuing as such with rank of Major General, till his death in Calcutta.

From a portrait by John Opie, R. A. (1761–1807).

He died in the early hours of the 21st, and Garstin writes ; "By the death of Colonel Colebrooke I have lost a near relation and a dear friend ; the Service an able, zealous, and active officer. He fell a victim to his exertions in the cause of service"[1].

Colebrooke had spent 30 years in India, with never a day's leave out of the country. His last 19 years were entirely devoted to survey, and he was over 14 years SG. It did not fall to him to make any historic innovations or discoveries, but he never missed an opportunity of adding to geographical knowledge, and he introduced order and regularity into the methods of the few surveyors who were allowed to him. Probably his most notable contributions were his svy. of Pearse's route along the East Coast, 1784–5 [I, 41–2],—of Mysore, 1791–2 [I, 112–3]—of the Ganges [I, 64–5 ; II, 21–3]—his obsns. and deductions regarding the heights of the Himālayan peaks [85–7]. He was a great diarist, as well as a pleasing artist [pl. 19*a*] ; his journals kept in Malaya [I, 327]—the Andaman and Nicobar Is. [I, 48, 327–8]—his essay on the Ganges [I, 329]—his sketches in Mysore [I, 328–9], and the journals of his last travels in the Upper Provinces [29–33, 387–90], are all most fascinating.

His family had probably left for England some time before his death, but we have no record of this. Though the Directors would not accept Garstin's request that he should be allowed to complete and pub. the General Map of India for their benefit [281], they made Mrs. Colebrooke a small donation of £ 300. Her eldest son Richard served in the Ben. Inf. ; a dau. Emma, b., Calcutta, 1–12–1799, came out again to India with Garstin in 1818, and was m. at the Cath., Calcutta, 20–12–20, to Wm. Colebrooke, RA. [*inf*], while one of her elder sisters m. Joseph Taylor, Ben. Engrs.

The Taylor family at one time held a portrait in oils, now lost, but still hold the miniature in water-colours from which the portrait on pl. 19 is reproduced.

This miniature appears to have been painted in Calcutta between 1790 and 1795, the latter year, being that of his marriage, being the most probable. The uniform shewn, scarlet with dark blue collar, appears to have been that of an officer on the staff,[2] viz. Asst. to SG. from July 1789, and later SG. [I, 327, 329].

COLEBROOKE, William Macbean George. RA.

b. 1787. d. 6–2–70.

2/Lieut. 17–8–03 ... Gen. 26–12–65 ; Col. Comdt. RA. 25–9–59.

Son of Paulet Wellbore Colebrooke (d. 1816), Lt Col. RA., by a dau. of M Gen. Grant.

m., Calcutta, 20–12–20, Emma Sophia, dau. of Robert Hyde Colebrooke [*sup*].

KH. 1834 ; Kt. Bach. 1837 ; CB. (civ.) 1848.

1811–3, MS. to Gillespie, Comdr. of the Forces, Java ; Nov. 1811, "Descriptive remarks on the Route & Country along NE. Coast of Java. Written on the March of the British Troops from Samarang to Sourabaya"[3]. May 12th. Recce. sketches at E. end of Java ; Aug. to Oct., survd. Solo R., completed later by George Everest [135, 137].

JMC. 7–6–13, in ch. of DQMG.'s Dept. ; Nov. 1813, to Bengal ; 1815–6, back in Java as DQMG., till evacuation.

1834–56, various appts. as Lt. Govr. and Govr. in W. Indies.

COLLINS, Charles James. Mad. Inf.

b. 18–3–1785. d. 6–12–04, Ganjam.

Lieut. 20–7–01.

Son of Charles Collins, of Swansea.

1803, Route svys. during occupation of Orissa [23], including one along Mahānadi R. for about 80 m. west from Cuttack, Oct. Nov. 1803[4].

COLVIN, John. Ben. Engrs.

b. 20–8–1794. d. 27–4–71.

Ens. 15–9–10 ... Lt Col. 20–4–35 ; ret. 4–9–39.

Son of Thomas Colvin, merch. of Glascow.

m., Ludlow, Salop, 27–2–38, Josephine Puget, dau. of Capt. Joseph Baker, RN.

ed. Addiscombe. *Oriental Club.* Hodson, I (368–9).

BMC. 22–2–11 ; tr. from Art. to Engrs. [308].

ib. 13–1–12 (167–8), to examine Palmyras Point for site for a lighthouse [24] ; Oct. 1813, Asst. to Blane on svy. E. of Sāgar I. [16, 311], on SG.'s report that "Major Garstin is anxious that Ensign Colvin of his Corps should get an insight into surveying, and the young Gentleman himself would be very happy to attend upon Lieutenant Blane in that capacity"[5].

Dec. 1813, to Allahābād ; MRIO. M 397 ; 17 (51) ; Svy. of "land to be given to H.H. Umrat Rao", Bundelkhand ; 30–10–15 to 4–11–15.

CONNER, Peter Eyre. Mad. Inf.

b. 5–8–1789. d. 29–4–21, Hyderābād, unm.

Ens. 28–2–07 ... Bt Capt. 27–3–21.

Son of John Connor[6], of co. Donegal.

June 1807, MMI., cl. III [320] ; from Jan. 1810 under Garling on Kālahasti–Tirupati svy. [127, 399] ; Nov. 1810, to Goa, survg. route Bangalore to Mangalore ; 30–6–11, relieved from Goa svy., being granted further 6 weeks "to complete draughts of survey before joining Corps" [156 n.5, 164].

MMC. 21–9–13, appd. Asst. in the SG.'s Dept., and joined Garling on svy. of Sonda, N. Kanara [158–9, 216, 314] ; MPC. 8–12–15, appd. to ch. Coorg svy. ; 1817, to Travancore svy. ; 1821 to ch. Hyderābād svy., but died immediately after taking over [130].

COURT, Charles. Bo. Mar.

d. Calcutta, 9–9–21.

Vol. 15–4–1789 ; 2/Lieut. 18–7–1793 ; Senr. Capt. 24–12–16. Mar. Survr., Ben., 13–2–12 to death.

m., Mary Anne, dau. of Geo. Sowley Holroyd, barr., later Judge of King's Bench (*DNB.*) ; she d., Calcutta, 15–5–13, aged 24.

1794–5, comdg. *Panther* [I, 355], survd. Red Sea to Suez.

[1] to Sackville, 5–10–08 ; DDn. 81 (213). [2] Confirmed by Sir Patrick Cadell, following BGO. 11–7–1787 and *Dress Regns., Bengal*, 6–3–23 (13). [3] Blagden (241). [4] MRIO. 63 (27) ; 4. O. 03. [5] DDn. 143 (3), 21–10–13. [6] Name thus spelt in affidavit, 4–2–06, with cadet papers, IO, and in *EIR.*, but in correspondence always Conner.

1804, "Captain Court, who had a high character both as a seaman and a man of science, took command of the 'Panther', with Lord Valentia...on board, and two midshipmen, ... Hurst and Crawford, while Lieutenant Maxfield [168] had the tender "Assaye". ... Sailed from Bombay on December 4th 1804, surveyed part of the Dhalac Islands...January 1806. ... The result of the surveys...are given in a chart of the Red Sea in two sheets in Lord Valentia's travels"[1].

1807–8 ; Sec. to Marine Bd. ; 1809–10, furl. to Europe.

COWPER, William. Bo. Engrs.
b. 12–4–1774. d. 27–5–25.

Ens. 1–4–1793 ... Bt Lt Col. 4–6–14 ; ret. 16–12–18.
Son of Wm. and Mary Cowper, of London.
ed. RMA.
m., 12–8–19, Lydia, dau. of Dr. Richard Reed, of London.

EIMC. III (195) ; "Appointed Assistant to John Johnson, employed in surveying the Coast and interior of Malabar [I, 131, 341], with whom he continued for several years, until obliged to relinqusih from ill-health. He then took the usual routine of duty, distinguishing himself by the correctness and highly finished style of his plans and surveys...till 1804, when he was called to the field as Chief Engineer to the army under Lt-General Sir Richard Jones".

Bo MC. 16–1–02, selected to comd. Pioneer Corps, but refused owing to ill-health.

1804–5, serving "in the double capacity of Surveyor and Field Engineer", survd. route of "the Division of the Bombay Army under the command of General Jones during the war against Jeswunt Rao Holkar, from Baroda to Bhurtpoor" [165–6].

DDn. 246 (141), date unkn., survd. route from Surat E. to Songarh[2] ; About 1806, in ch. of the building of naval docks at Bombay.

1812, with Poona Subsy. Force in the Deccan ; "The army marched from Siroor[3] on the 3rd August and, altho' I did not arrive at the Head Quarters at Pundapoor[4] till the 17th, I commenced my survey from Poona on the 7th of a route not laid down in any maps I have seen. ...

"As the Topography of the country through which they had to pass was altogether unknown, Colonel Montresor[5] [95 n.4] deemed it necessary to send me forward in order to gain every possible information that could facilitate the movement of the army, and particularly to discover passes thro' which artillery could be drawn.

"I succeeded in pointing out the pass of Kaledran, by which road the army afterwards moved. ... I was seldom 3 days together at Head Quarters, but constantly employed... in gaining every information requisite for the progress of the army.

"In performing these duties during the height of the monsoon, I travelled upwards of 300 miles, and notwithstanding the inclemency of the weather, made repeated forced marches from 18 to 26 miles during the day, after which the unwillingness of the natives to give me the intelligence I required, and without which I could not have proceeded, continually kept me from taking any rest till 2 or 3 o'clock in the morning"[6].

CRAWFORD, Charles. Ben. Inf.
b. 1760. d. 23–12–36.

Ens. 25–7–1779 ... Col. 4–6–13 ; ret. 10–6–18.
SG. Bengal, 1813–5.

Bro. to James Crawford (Caesar[7], d. 1778), Hodson, I (408–9) [*inf*], and to another bro., who probably never came to India [231 n.3].

m., in England, between 1786 and 1789, Anne Louisa [*inf*][8]. Hodson, I (408–9).

1781, campaign against Rāja of Benares [I, 35 n.8, 394] ; serving as Asst. Engr. at capture of Bijaigarh, 10–11–1781 ; "on rough survey" of Kaimur Hills [I, 315 ; II, 45].

2–8–1785, applied from Buxar for leave to Europe, and permitted to retire for this purpose in absence of furl. rules [I, 267] ; CM. 11–2–1789, permitted to return to duty, taking his wife.

BGO. 12–2–1793, resd. the service for private reasons ; "Could your Memorialist have procured a twelve months' leave of absence he would not have resigned the service but, finding that impossible, he was necessitated to do it".

His petition to the Directors from Ghāziābād, 19–12–93, for re-instatement, pleads his own 14 years service, and "the well-known services of his brother, the late Captain James Crawford, who had the honour of Commanding one of their Battalions for many years". In granting this, 8–7–95, the Directors added "We must...declare our disapprobation of Officers resigning our Service with the view of pursuing other objects, and afterwards applying for restoration".

Wrote from Krishnagar, 16–11–1796, that he had "served upwards of four years as an Assistant Engineer and Surveyor"[9] His wife and her maid, Mary Slater, were given passages to England early in 1796.

1802–3, comdd. escort with Knox's mission to Nepāl and, with hdqrs. at Kātmāndu for about a year, made svys. and maps, with astr. obsns., trgtg. the valley of Nepāl, and fixing positions and heights of snow peaks [6, 7, 40, 70–3, 85, 89] ; granted Rs. 3,000 reward ; missio withdrew March 1803[10].

Drew map to illustrate Buchanan's tour of Mysore & Kanara, original, MRIO. 143 (1), bearing his signature [113 n.3, 384].

Comdd. batt. at Sultanpur[11], making ocasional svys. in neighbourhood. Dec. to March, 1804–5, ran svy. from Bihār to Rohilkhand, to sketch mountains and rivers, and fix heights of peaks [27, 35, 71, 73, 85–6]. Interrupted by *pindāri* invasion, distinguished himself by defence of "Putturghur" fort, 3 m. from Najibābād and 25 m. from Hardwār[12]. This was "productive of the happiest effects by establishing confidence at a very critical period, and by preserving from pillage a place which, at this time, was rendered singularly important by being the repository of the wealth and valuable effects of the inhabitants of the Northern part of the Province"[13].

1809–10, survd. Etāwah Cant. ; date unkn., survd. Benares Cant., obsg. latitude, quoted by James Prinsep[14] [28].

May 1812 to Feb. 1813, on svy. of Mirzāpur Dist.[15] [193], with Hugh Morrieson of his batt. as asst. [45] ; being nominated SG. in Nov. 1812, was not released from svy. till relieved by Smith, and did not assume office till 9–4–13 [6, 16, 45, 47].

[1] Markham (7–8). [2] 46 G/12. [3] Sirūr, 47 J/5. [4] Pandharpur, 47 O/3, 40 m. W. of Sholāpur. [5] Probably Thos. Gage Montresor (1774–1853), comdg. Poona Subsy. Force, 1809–13 ; that on p. 95 being John Montresor (1768–1805), comdg. HM. 77th Ft. [6] Bo MC. 2–2–14. [7] Neither Burke's *Landed Gentry of Ireland*, nor "Bengal Wills" give "Charles" amongst brothers of "Chota Crawford". [8] CM. 11–2–89, granted passage to India. [9] BMC. 21–11–1796 (43). [10] ib. 24–8–05 (76). [11] 63 J/3. [12] *Imp Gaz.* XVII (423) & XXII (19). [13] From AGG. BSC. 16–5–05 (359). [14] *As R.* XV Appx. (191). [15] Mirzāpur to Mhow May 1812 ; Mhow to Rotās, Oct. 1813 ; DDn. 270 (33).

Being an experienced survr. his instns. to the survrs. in the field, very few of whom he ever saw, were full of practical advice [35, 84]. A keen astronomer, he restarted regular obsns. at SGO., holding classes for officer pupils [193].

On appt. of Mackenzie as SG. of India, Crawford continued as SG. at Calcutta pending Mackenzie's arrival from Madras, but "in consequence of my general health and strength being much weakened by my late residence in Calcutta" resd., and left Calcutta 24–12–15 to embark at Sāgar Roads.[1]

Settled at Bivia House, Goodrich, Hereford, where he died.

CRUIKSHANK, James. Bo. Inf.
b. 24–4–1788. d. 29–11–53.

Ens. 14–9–04 ... Maj. 25–5–29 ; ret. 30–4–31.

Son of John Cruikshank, clerk at the Navy Office, and Barbara Sutherland his wife ; cousin to James Sutherland [qv] ; his sister married Henry Adams [376].

m., London, 15–11–38, Eliza King Josephine, dau. of Joseph Bothamley.

July 1808, attd. svy. ; 1809–10, Asst. Survr. under Williams in Gujarāt, and drew resulting map [171–3, 323].

From 1811, Asst. Survr. on svy. of Broach, and continued on rev. svys., Gujarāt, till end of service [188].

DALGAIRNS, James. Mad. Inf.
bapt. 3–1–1787. d. 5–11–75.

Lieut. 21–9–04 ... Lt Col. 15–5–34 ; ret. 29–2–40.

Son of Andrew and Charlotte Dalgairns of co. Forfar.

Oriental Club.

April 1805, MMI., cl. I [320] ; Dec. 1807, to Travancore svy. [131–2] ; Nov. 1808 to April 1809 under Malcolm at Bombay [131 n.10], returning to Travancore.

MGO. 14–2–11, to join his corps, 7th NI. ; ib. 9–4–11, to Java expn., doing duty with HM. 14th Regt. [320] ; 1813, with Amboynese Corps, Java ; JMC. 2–4–14, to act as Town Major, Batavia, and ADC. to Lt Govr. ; Oct. 1815, on Rev. Com. ; July 1816, Sub-Treasurer and Civ. Pymr., Batavia.

MMC. 27–4–13, appd. 2nd class Asst. in QMG.'s Dept., Svy. Branch [322].

ib. 30–12–17, furl. to Europe.

DARDELL, James Francis (Jacques François). Bo. Engrs.
b. 12–3–1773. d. 6–1–05, Cochin.

Ens. (Bo. Inf.) 19–3–1791 ; tr. to Engrs. 24–3–1794 ... Capt. Lieut. 11–1–02.

Son of Rev. David Dardel [*sic*], pastor of Neufchatel, Switzerland, and Marianne d'Iveroy, his wife.

m., Cochin, 2–9–1798, Petronella Margaretha Vanspall (Dutch) ; father of James Colin Dardell (1804–1831), Mad. Inf., survr. 1830.

1798 till death, stationed at Cochin, and made various svys. [131].

DASHWOOD, Henry William. Bo. Engrs.
b. 28–5–1796. d. 15–11–20, at sea.

Ens. 28–11–12 ; Lieut. 1819 ?

Son of James Dashwood of London and Sarah Moseley, his wife.

CD to Bo. 18–12–12, retained in England as cadet for course of svy. [308].

Bo RC. 12–10–14, lately arrd. Bombay ; "sitting idle", posted as asst. to Rev. Svy. Bombay I.

As J. 1821 (200), Conspicuous in numerous sieges during conquest of S. Konkan ; d. at sea as Lieut. on board the *Hannah* "of a decline".

DAVIDSON, Charles James Collie. Ben. Engrs.
b., Calcutta, 24–10–1793. d. 31–3–52.

Ens. 10–12–14 ... Lt Col. 31–3–40 ; ret. 22–10–41.

Son of Alexander Davidson, Calcutta merch.[2], and Anne Ellen his wife.

m., Calcutta, 3–2–18, Letitia Crump. Hodson, II (15).

DDn. 131 (136), 26–3–15, Jan. to March 1815, survd. Dum Dum cant. [18, 311], and road from Calcutta, *Ben Regr.* 10 (58).

DAVIDSON, Michael Hyndman. Mad. Inf.
b. 7–12–1789. d. 12–6–28, Madras.

Lieut. 9–9–05 ; Capt. 3–3–24.

Son of Andrew Davidson, shipmaster of Greenock, and Margaret his wife.

April 1806, MMI. cl. II [320] ; 1810, after 2 years regtl. duty, employed on svy. ; MGO. 12–3–11, attd. to QMG.'s Dept., svy. branch [164] ; ib. 18–5–13, appd. to commt. dept. [322].

DAVIES, Thomas. Mad. Engrs.
b. 7–11–1789. d. 18–5–18, kd. in action at Malegaon, Deccan[3] ; MI. St. Mary's ch., Ft. St. George.

Ens. 10–11–09 ; Lieut. 6–4– or 15–11–10.

Son of Thomas and Margaret Davies of co. Denbigh.

1–11–12 to 17–4–14, Survr. with field force under Dowse in S. Deccan [166, 313] ; M Pol C. 23–12–16 [11, 13], commended by Elphinstone and SG.

1817–8, on svy., Marātha War.

DE HAVILLAND, Thomas Fiotte [I, 334]. Mad. Engrs.
b. 10–4–1775. d. 23–2–66, in Guernsey.

Ens. 3–5–1793 ... Lt Col. 1–5–24 ; ret. 20–4–25.

Son of Sir Peter de Havilland, Kt., of Havilland Hall, Guernsey.

m., 1st Madras, 3–9–08, Elizabeth, dau. of Thos. de Saumerez ; she d., Madras, 14–3–18, MI. St. Mary's Cem.

m., 2nd, Harriet, dau. of Anthony Gore.

DNB. ; *DIB.* ; Vibart, II. *Oriental Club.*

1799–1800, sketch of Coimbatore and Dindigul[4] [I, 114, 118] ; 1800, Engr. at Seringapatam.

1801, with Baird's force to Egypt ; survd. Lake Mareotis and Cairo–Suez desert for water ; MMC. 18–5–04, returning in "the Company's extra ship Admiral Aplin, ... captured by the French Privateer, the Psyche", 9–1–04. Released on parole 2–2–04 ; ordered to be employed "on any Military Service in this Country except in acts of immediate and personal hostility against the French", and "in the Interior of the Country"[5]. MGO. 21–10–13, released from parole.

MMC. 15–4–05, posted as Engr. with Hyderābād Subsy. Force [3], with directions to complete svy. of Deccan begun by Mackenzie [I, 117–8] ; joined on borders of Berār and survd. N. frontiers [133–4, 280, 312–3].

Jan. 1807, to ch. of repairs at Seringapatam ; 1809, took leading part in mutiny [313–4]—elected for ctml.—sentenced to be cashiered—dsmd. and not restored till 1814 [000][6].

1812, Govt. bought his maps and insts. for 900 *ps.*, tho' he had valued them at 2,500 *ps.* or even £ 1,000 sterling [225–6]. He claimed that he had employed dmn. for nearly 3 years,

[1] DDn. 131 (155), 17–8–15. [2] Leith Alexander or his bro. A. S. Davidson, of Messrs. Hogue, Davidson & Robertson, Lambton's Calcutta agents. [3] 46 L/10. [4] MRO. Map 81. [5] M to CD. 8–3–05 (110–2) ; cf. John Byres [I, 321]. [6] Cardew.

costing about 600 *ps.*; Amongst the maps was one of Egypt, for the original of which the Directors had paid him £ 100; there was also a map of "the track of the Rockingham, & the shoal struck upon in 1801 in the Red Sea"[1], and map of S. India in 6 sheets [276].

From 1814 actg. Inspector Tank Repairs [147] and CE. Madras; took tidal obsns.; "a datum line known as De Havilland's Benchmark may yet be seen on a stone let into the wall at Fort St. George"[2]. Built St. Thomas' Cath., designed by Caldwell [I, 321]. Mackenzie regarded him as "an active enterprizing man" who aspired to "éclat as a Geographer".

DE PENNING, Joshua. Asst. Survr.
b. 9–8–1784, Chingleput. d. 2–3–45, Calcutta.

Appce. at Obsy. School, 21–6–1798 [351]; Sub-Asst. 9–9–03; Asst. Survr. 1st cl., Jan. 1815; ret. Nov. 1843.

2nd son of Peter De Penning, sergt. of Mad. Art., who m. Marie Sicé, of Tranquebar & Pondicherry, 24–7–1780[3].

Joshua, with his bro. Peter, was brought up with the sons of Lord Hobart[4] at Govt. Ho., and then sent to obsy. survg. school [341].

m., Pondicherry, 18–6–10, Marie Elizabeth Hypolitte Gille, b. 8–7–1796 and therefore under 14 years old, by whom he had 14 children, of whom 11 grew up and 9 survived him. The 9th child, b. 1814, was named Wm. Lambton, and went to sea; the 11th, George Alfred, b. Madras 7–7–30, left descendants now living at Old Court Ho. St., Calcutta, who conduct the business of Patent Agents under the name of *De Penning & De Penning*, and still preserve documents left by Joshua, from whom many of the following particulars were obtained. The youngest son was named Duncan Montgomerie, after the DSG. Madras [319, 321].

Joshua was "brought up in the Military Male Orphan Asylum at Madras, whence he was originally bound apprentice to a Mr. Adderley[5] who, on returning to England, sent him to the Revenue Surveying School in June 1798, to serve out the remainder of his time, which was nearly 5 years"[6].

Aug. 1800, joined Lambton's svy. [164, 346]; 1–1–07, awarded by Bd. of Rev. a silver medal and a case of math. insts. "as a mark of their approbation" [347].

DDn. 62 (88), 6–1–09, promoted to 35 *ps.* a month on completion of 6 years from expiry of appce. ship; "Mr. J. de Penning had been with me since the year 1800, and from a continued course of uniform good conduct and attention to his duty he is entitled to the strongest recommendation... both as to his moral character and to his superior qualifications in the complicated line in which he has been employed"[7] [346].

1809, made all the obsns. on Great Arc, S. from Perriomalli, lat. 9° 13′ [243, 264, pl. 17][8].

1812, on trgn. Nellore to Bellary—Dec. 1812 to March 1813, Bellary towards Chitaldrug—Sept. 1813 to March 1814, Bellary to W. coast and back [4, 246–8, 335] having measured base at Kumta [248, 255]. The following extracts are taken from his journal [248–9];

21–3–13. "After sunset was putting up the instrument to descend, when one of our people cried 'A Bear, a Bear', upon which we looked about, & true enough we discovered a Bear roaming about unconcerned on a neighbouring declivity. ... I turned the telescope to the animal, and I had the satisfaction to make a discovery which I probably will never again be able to do, and which I never knew or heard of before. This is that the bear carries its young on its back while too young to follow the mother. The young clings fast to the back, transversely, its head and forelegs on one side and the hinder part on the other. ...

"24th. Marched to Bussapoor, at the W. foot of Rungyandroog[9]. ... I got a very curious large red squirrel shot, the carcass of which I now have by me, dried and stuffed. I have also got a large curious spider pickled, which I happened to meet with very luckily by some bamboos that were cut down for my use; out of a hollow of one of these this spider came out before it was quite dark. ...

7–10–13. "Marched to...a small village about 6 miles nearly E. from Hurryhurr [95 n.2]. Ascended the hill with the Instrument. Destroyed a honeycomb which we discovered on the rock with the help of our people, as the inhabitants were afraid to approach it. ... The villagers would not give us any assistance to get at the bees, imagining from some superstition or ignorance that the bare attempt to destroy a Honeycomb would be attended with instant death, and that no one else could dare to destroy a comb but those whose business or trade it was, and who of course is supposed to be acquainted with magic, by which power alone a person could succeed. As I was determined on having the Honeycomb destroyed, having occasion for some honey, I got the villagers' consent, and sett my people to work, who were at first as shy and superstitious as the villagers, but after some hesitation at last succeeded without meeting any accident, and to their great surprise and shame, they discovered that fear was the only enemy they had to encounter. The bees are very revengeful when they are disturbed, but when fire is applied to the comb they seem to lose all their sagacity & power, and instead of venturing to sting their adversaries, they adhere faster to their comb, as if determined to perish with it".

The journal makes no mention of the trouble with the *amildar* of Shikarpur towards the end of 1813, which raised a storm in official circles. De Penning had failed to get the asstce. he expected in the way of supplies, and unfortunately struck one of the local officials [371–2].

March 14th 1814, left Bellary to join Lambton at Hyderābād.

"16th. Marched to Adoni. ...

"20th. Marched to Rachoor[10]. ... Having crossed the Toongabudra, were now in Nizam's Territories. The inhabitants insolent and haughty, and provisions &c. in consequence were obtained with many difficulties. ...

"22nd. Crossed the Kistna.

"29th. Marched in to the French Gardens[11] called Raymondpett, where we joined Major Lambton after a separation of 6 months and 19 days, which took place on the 10th of September [1813] at Bellary. The French Gardens, ... on the S. bank of the Musi River, about 3 miles E. from the City E. gate, and about the same distance from the Residency in a direct line, ... may be distinguished at a distance from the Monument erected by the late Nizam in honour of Mr. Raymond[12], and which is held in great veneration by the R.C.'s and also by several Mussulmen. ...

"Our friend & associate Rossenrode [246, 352] left us in April for Masulipatam, to be joined in wedlock, and returned with his wife in May.

"Since my arrival here I have been frequently taken ill of a fever, which I suppose to be of the same nature I was attacked with at Bellary. My wife was safely delivered of a daughter on the morning of the 20th of April, ... and I have been attacked with a fever, as also my wife, on the

[1] MMC. 4–5–10; DDn. 127 (272), 15–9–11; MPC. 2–6–12. [2] *GTS.* XVI (5). [3] *Contrat de Mariage* in posession of Family. [4] Govr. Madras, 1794–8. [5] Edward Hale Adderley (1771–1870); son of Thos. A. (d. 1791) of co. Cork; *OW.* I (5); PS. to his step-father, Lord Hobart, who left Madras Feb. 1798. [6] SG. to Govt. DDn., 198 (36), 30–4–23. [7] from Lambton, DDn. 62 (92), 26–12–09. [8] DDn. 4)2 (248–368), 13–8–42, para. 153. [9] Rangyanadurga, 2,307 ft., 57 B/2. [10] Raichūr, 56 H/8. [11] Formerly occupied by Raymond's force, disbanded 1798. [I, 117, 175, 350]. [12] Michel J. M. Raymond (1755–98); arrd. India 1775; comd. French force Hyderābād *c.* 1785–98. *DIB.*; MI. Hyderābād, Crofton II (33–4).

same day, and the child taken ill of a flux a few days after, from a change of milk. I recovered on the 19th, but my poor wife still continues ill, as also the child.

8–8–15. "The Colonel sett out for the Cant. at 3 ; Rossde. lost a turkey by the dogs.

"9th. Killed a whipping snake in the Office necessary"[1].

In recdg. De Penning for increase of salary in 1817, Lambton writes that he was "so fully qualified in 1813 that I entrusted him to carry a belt of triangles, principal and secondary, between the latitudes of 13½° and 15° entirely across the Peninsula, and he accomplished his task in a most masterly manner. ... Mr. De Penning stands in a very superior height, both as to his attainments and the respectability of his character. He is competent to the practical part of this Survey in all its various branches, thoroughly acquainted with the adjustments of all my instruments, is an excellent practical Astronomer, and his great length of zealous and valuable services entitle him to my thanks and the highest consideration of Government"[2].

He was permitted to resign from the GTS. with a pension from 1–2–24, and was then employed in the SGO. at Madras until called up to Calcutta by Everest at the end of 1831, to take ch. of the computing office ; he held ch. of that office till he ret. Nov. 1843 [266].

DICKINSON, Thomas. Bo. Engrs. b. 16–4–1783. d. 19–4–61.

Ens. 21–9–1798 ... Col. 14–6–42 ; ret. 10–5–43 ; Hon. M Gen. 28–11–54.

Son of Thomas and Frances Dickinson.

m., Bombay, 14–4–08, Catherine, dau. of M Gen. Josiah Dean.

ed. RMA.

Bo GO. 17 & 31–12–1799, attd. to Inf.

Bo RC. 19–2–12, appd. to succeed Hawkins [qv] in ch. of Rev. Svy. of Bombay I., with appt. of Rev. Survr., which he held till 1821 [8, 186–7, 306, 323, 338, 355].

Had heated dispute with one of his survrs., Justinian Nutt [qv], from whose correspondence the following extract is taken ;

"The 1st and 2nd mornings of going out after Captain Dickinson's arrival, he quitted the encampment before us without saying a word, and we joined him on the road ; on the 3rd. however, it was our fortune to set out first, and we arrived on the ground ¼ of an hour before him, on which he said he had been waiting 10 minutes, and then visited my tent to ascertain where we were, and ordered us in future to stop for him. Returning home, however, some one observed it was nearly 9 o'clock, on which he remarked that his watch wanted ½ an hour of that time, and then ascribed to this cause his having been so late, and that he had overslept himself.

"One day he even took a pen knife out of my hand and showed me how to make an erasure, on the plea of my being ignorant of the method ; another time a pair of compasses to show me how to divide a line into 12 equal parts ; I merely mention these things to evince on what trivial subjects he could find fault".

Govt. ordered that "being of opinion that the Public Service would not be benefitted by Lieutenant Nutt's remaining as an Assistant, ... [they] have...placed him in another situation, but that on a full consideration... believe that Captain Dickinson has shown a want of temper on several occasions...and hope that the duties of his situation will be conducted in future in a way that may be most likely to ensure a hearty co-operation of the officers employed in his department"[3].

DINWIDDIE, Dr. James. Scientist. b. 8–12–1746, at Kirkland Farm, Tinwald, nr. Dumfries. d. 19–3–1815, bur. St. James' chyd., Pentonville, Islington.

Not a survr., but in 1800 sold svy. insts. used by Lambton [3, 233, 251–2].

Son of John Dinwoody, who d. May or June 1746. Changed name to Dinwiddie : cousin of Robt. Dinwiddie, Govr. Virginia, 1751–8.

ed. Dumfries Academy and Edinburgh Univ. ; MA. 1778 LLD., 1792.

m. before 1777 ; his only child Ann d. 28–11–30, aged 53 ; she m. James Proudfoot, gunmaker of Dumfries, and their son, Wm. Jardine Proudfoot wrote bio. memoir of his g father, pubd. Holwell, Liverpool, 1868, which contains photo of a bust.

Robbins (181) ; Carey, I (92) ; Family records ; "*Some notes on Dumfries Educationists*...by A. Cameron Smith.

As a schoolboy made clock of original design in local wheelwright's shop.

ed. for Ch. of Scotland, but timid and afflicted by squint ; after maiden sermon devoted himself to science. Worked as private tutor till, 1771, appd. head math. master, Dumfries Academy. Hon. Burgess, Dumfries, 1775.

Spent £ 150 on providing math. insts., theodolite, microscope, parallel rulers, compasses, double cone, and inclined plane, which, with 350 books, he left at the Academy when he left Dumfries, 1777.

Visited principal towns of Scotland and Ireland on lecture tour—Cork, 1780—then London and Paris ; constant financial trouble ; Lectured on steam engines—diving bells—balloons—Siege of Gibralter—cotton spinning. Had schemes for salvage of ships, including *Royal George* [I, 317].

1792, Appd. to Lord Macartney's embassy to China [251] ; title of "Machinist or Mechanician" changed to "Astronomer" at his own request. Embarked, Portsmouth, 26–9–1792. Besides the insts. later sold for Lambton's svy., he was to demonstrate air-pump, lenses, planetarium, balloon, diving-bell, making personal ascents and descents in two last.

The intended presents not appreciated as expected ; several of them left with Dinwiddie in payment for services. Leaving embassy to return to Europe, he arrd. Calcutta 27–9–1794.

From 1795 to 1806 gave frequent lectures in Calcutta "on Natural Philosophy & Chemistry", charging 10 gold *mohurs*[4] for course of 25 to 30 lectures[5]. Gave demonstrations of galvanic battery. *IO. Tract* 44, "Analysis of a course of Lectures in Experimental Philosophy". Calcutta, 1801.

B to CD. 24–8–1795, appd., probably from Feb. 1795, "to assist the Board of Trade in points of Chemistry, Mechanics, and Natural Philosophy, relating to the affairs under their charge, with a salary of Sicca Rupees 500/- per month for one year".

The work covered research and experiments with indigo, cochineal, saltpetre, gunpowder, flax, and hemp, besides indigenous timber suitable for house and ship building.

1797, Council reported that "having called on the Board of Trade to state how far the object of his appointment had been answered, ... it did not appear to us...that the prospect and advantage to the Company was sufficient to justify a continuance of his salary. ... We determined that his salary and appointment should cease from the end of January last"[6].

[1] Privy tent. [2] DDn. 62 (8), 27–11–17. [3] Bo RC. 27–4–14. [4] Rs. 16 each. [5] Carey, I (181). [6] BPC. 27–1–1797, & B to CD. 2–3–1797 (49).

During Lambton's short stay in Calcutta, he must have met Dinwiddie and seen the scientific insts., for as soon as he had obtained approval to his svy. in the south peninsula, he persuaded the Madras Govt. to purchase those he wanted, at a cost of Rs. 3,700 and after inspection they were packed off to Madras early in 1800 [252, 383, 386, 414].

On the founding of Ft. Wm. Coll. in 1800 [308], Dinwiddie was appd. "teacher of Experimental Philosophy", on salary Rs. 500 pm., which covered the coaching of both civil and mil. officers in science and maths.

In 1804 he pubd. an account of a cure for *chorea*, St. Vitus' Dance, effected with his galvanic battery[1].

Prominent member of ASB.

Having accumulated, it is said, a comfortable fortune during his stay in Calcutta, he left in 1806, returned to England, paid off his debts, and "rather deaf and in impaired health", revisited Dumfries, where he found that the collection of insts. he had left 30 years before was now held as the property of the math. master, who considered, however, that "experiments took off the attention of the boys".

Much of the infn. given in this note is due to the kindness of his gt.gt.g.nephew, of the present firm of Robert Dinwiddie & Co., printers & publishers of Dumfries.

DOUGLAS, Alexander Sholto. Mad. Inf.
b. 20–4–1785. d. 18–2–13, Rājahmundry ; MI.

Ens. 17–4–03 ; Lieut. 21–9–04.

Son of Peter Sholto Douglas.

1810–1, on svy. in Vizagapatam Dist. [123, 160, 164] ; his map still the best available in 1822[2]. DDn. 127, 4–9–11, "Lieutenant Douglas's services being no longer required, he will be directed to join his Corps. Surveying allowances are not to be drawn by him beyond July 31st".

DRUMMOND, James Samuel Robert. Bo. Engrs.
b. *c.* 1782. d. 12–3–31, Bath : probably unm.

Lieut. 26–5–1800 ... Lt Col. 29–7–25.

Son of James Drummond, Lt Col. Bo. Inf., and his wife Anne Croes ; his sister Jane m. Thos. Thatcher [qv].

Bo GO. 17–12–1799, posted to 2nd Batt. 3rd. NI. ; later reposted to Engrs.

Bo MC. 12–6–01, appd. Asst. to SG., but not considered fit for ch. of mapping in SG.'s absence [282 n.7, 305] ; resd. 1806 [323, 338].

1820, Ex-Engr. S. Div. Gujarāt.

DUNN,[3] Charles Denis. Mad. Inf.
b. 8–4–1787. d. 16–8–64, Bath.

Ens. 28–2–07 ... Lt Gen. 6–1–63 ; had 3 years previous service with Hessian Dragoons[4].

Son of Wm. and Frances Dun [*sic*].

m., 11–7–22, Miss Adria Snow.

June 1807, MMI., cl. III [320] ; under Garling on Kālahasti svy. [127, 399], and with him to Goa, remaining there till Aug. 1812 [156, 157, 164] ; "Subject to frequent attacks of an intermittent fever contracted on the survey"[5]. June 1812, applied for furl. for 9 months.

MMC. 24–6–17, acting Fd. AQMG. Marātha War ; MGO. 29–4–19, persian interpreter, Hyderābād Subsy. Force.

ELLIS, Robert. Ben. Inf.
b. 22–12–1786. d. 31–10–14, kd. in action at Kalanga ; MI.

Ens. 2–11–07 ; Lieut. 1814.

Son of Thos. and Elizabeth Ellis of Llannor, Wales.

Hodson II (133).

BMC. 19–12–09, recdd. by SG. for svy. of old canals in Hissār, being "now attached to the Pioneer Corps" [69]. Survd. Karnāl and Sahāranpur Cants. [61] ; DDn. 128 (29), 2–3–11, survd. route Karnāl to Kalewar, Oct. 1810.

1811, Expn. to Java ; DDn. 126 (137), 9–4–12, CE. recds. him for employment on Engr. works ; "now of the Pioneer Corps, just returned from Java. This young Gentleman was considered as an Officer of promise by His Excellency Lt.Genl. Hewett [160 n.6], who meant to have employed him if occasion had presented itself".

1813, compiled *Map of British Possessions W. of Jumna* [270].

Name inscribed on Gillespie monument, Dehra Dūn.

ENNIS, William Michel. Bo. Engrs.
b. 17–2–1794. d. 13–11–17, kd. on active service.

Ens. 12–7–12.

Son of Thos. Ennis of Carrickmacross, Ireland.

CD. to Bo. 18–12–12, retained in England as cadet for a course of svy. [308].

Bo RC. 12–10–14, lately arrd., posted as asst. to rev. svy. Bombay I. [187].

Marātha War ; "Lieut. Ennis...who was surveying, attended by a small guard, was attacked and killed by a party in the service of Trimbukjee Daignia"[6].

EVEREST, George. Ben. Art.
b., Greenwich[7] 4–7–1790. d. 1–12–66.

Lieut. 4–4–06 ... Lt Col. 7–3–38 ; ret. 16–12–43 ; Hon. Col. 28–11–54.

STS. 1823 [252–5, 262, 267] ; SG. & STS. 1830–43 [9, 190].

Son of Wm. Tristram Everest, solicitor, of Greenwich, and Lucetta Mary his wife.

m., 17–11–46, Emma, dau. of Thos. Wing, of Gray's Inn, attorney-at-law.

His last surviving son, L. F. Everest, solicitor, d. 1–4–1935, has left an interesting memo. on Everest and his family.

IO. Misc. 43 (162), at age of 13, proposed by John Manship[8] as cadet for Ben. Art. or Engrs. ; ed. 5 months, RMC. Marlow and 7 months RMA. Woolwich.

FRS., 8–3–27 ; FRAstS. ; FRIGB.[9] ; FRGS. ; CB. 26–2–61 ; Kt. 13–3–61.

Markham (83–95) ; *DNB.* ; *Ency Brit.* ; *DIB.* ; Hodson, II (145).

1812, Siege of Kālinjar on pol. duty[10].

1812 or 1813, to Java on regtl. duty ; June 1815 to Aug. 1816, on svy. of Solo R. from Samarang [137, 216 n.3] ; July to Aug. 1816, recce. of harbours along S. coast[11] [138, 380] ; JMC. 29–7–15, retained in Java "conducting an important Survey... which it is...desirable that he should finish" [323].

Govt. Gaz. 21–11–16, on evacuation of Java, sailed in *Lady Barlow* from Batavia 28–9–16—Malacca 8–10–16—Calcutta 20–11–16. *Penang Gaz.*, 19–10–16 ; "On Wednesday came in the two transports, James Drummond and Lady Barlow, with troops returning from Java to Bengal. We were sorry to hear they were compelled to put in here in consequence of the smallpox having made its appearance on board the latter vessel".

[1] *As AR.* 1805 ; 12–11–04. [2] DDn. 194 (123), 5–8–22. [3] sometimes DUN. [4] MMC. 29–1–11. [5] ib. 10–12–11. [6] Bell (54). [7] not b. at Gwernvale, co. Brecknock, as stated in *DNB.* and Hodson, *v* regr. at St. Alfege ch., Greenwich. [8] Director EIC., 1755–8, 1762–1809. [9] Fellow of the Royal Institute of Great Britain. [10] Geo. Everest (38), unconfirmed. [11] IO Maps. MS. 24 is labelled as Everest's journal, but appears to be really Baker's. MRIO. M. 440 is possibly one of Everest's fdbks. ; several of his plans are preserved [137 n.5].

FLEMING, George. Ben. Engrs.
b. 1760/61. d. 3–7–18, Calcutta.

Fwkr. Art.; Ens. Engrs. 25–11–1778 ... Col. 4–6–14.

Son of George Fleming, of Dublin, and Thomasin Tucker his wife.

m., Dacca, 20–1–1794, Margaret, sister of David Burges, BCS., Collr. of Purnea widow of James Ayton and mother of James Alexander Ayton (1791–1832). Fleming's dau. by an earlier marriage [?], Sophia Thomasin, m., 1st, Henry Manley; 2nd, Chinsura, 16–10–20, the afore-said James Alexander Ayton[1].

Hodson, I (191); III (723).

BPC. 14–6–1779, Asst. Fd. Engr. with Goddard's army near Surat [I, 39]; BPC. 4–4–1786, Fd. Engr. Cawnpore.

1796, Engr. at Dacca, supdg. buildings of gaol; BMC. 4–4–1796 (35), appd. to report on measures necessary to protect Rangpur against inundation by Tīsta R.

1801–2, survd. environs of Calcutta [12–3, 191, 199 n.2, 268, 309]; Sept. 1802 resd. on account of ill-health, returning to Berhampore.

From Sept. 1812, survd. city of Murshidābād in addition to other engr. duties, which included construction of bridge over Gobra R. [18, 227, 312]. Greatly appreciated appt. of Schalch [310–1] as asst., writing to Crawford, SG.;

"From what you have said of your young friend, I feel much satisfied, & happy in the idea we shall do very well together; in fact I now have but one thought about him, viz., how & what I can be able to do to accomodate and make him comfortable. My Bungalow that I now live in is very small indeed, & Mrs. Fleming being with me renders it impossible to accomodate him in it; however that will not long be a hindrance, because when I go into the City, as soon as my Bridge-Arch is Turned, I mean that Mrs. Fleming shall go into Cantts., for I would not on any acct. suffer her to reside in such a dirty abominable place, for, as my charming Man said, if she was to *live 6 months there she would be dead in them.*

My arch will, I hope, be able to spare my escort & attendance at the end of next month, when, please God, I mean to go into a Friend's House in the City, & then Mr. S. & I shall, I hope, be able to do very well together. If he calls upon you, or if you write to Him previous to his journey, pray tell him the above, & say I hope if he comes before Oct. he will be able to bring a tent with him, and the same time I hope he will not think of bringing anything towards Housekeeping, as I trust we shall be happy eating as well as Working together, and it wd. be putting Him to an unnecessary expense.

"I hope chance has thrown a good Theodolite in his way, as the one I have is very crazy, tho' I made an effort some time ago to get another, I could not succeed.

"Mrs. Fleming desires her B'hut B'hut salam[2], & with me regards your kind attention to my Step son, Lt. J. A. Ayton [*sup*] to whom may I send the enclosed, wh. covers an introduction to you";[3] and two weeks later; "Mrs. Fleming, with B'hut salam, says she thanks you for sending Her Letter to Her Boy, & *we* hope that He has been to pay His respects to you. I hope you like your situation in *ALL* points of view; in One (as it favours your Penchant for Science) I am sure it does, but I hope it does also in another"[4].

Reference has already been made to the dmn., DeCruz [340], about whom Fleming writes; "If thro' your kind interference you can arrange it so that I may have Decruze confirmed to me, I shall like it much better than to have an Assistant from the Infantry; not from any dislike to, or disinclination to know, any of them, but because I feel myself more easy with Him than I could with *any Officer*, and further because he protracts and makes my plan for me and does it very prettily. I assure you therefore, my dear Charles, I wish you could hint as much, saying if you please that it is my Wish"[5].

The Murshidābād svy. was finished by July 1814, and in BGO. of 3–2–15, Fleming was posted to "the charge of the Engineer Department...consequent to the departure for Europe of Maj. Genl. Garstin" [402].

His friend Hugh Morrieson [402] writes to the SG. shortly after Fleming's death, "The accident...to...Colonel Fleming was a fall in his bathing room; he fell upon his head and cut himself severely. I at first understood that this was the cause of his death, but I have since learnt that he had his fever before, and that his fall proceeded from weakness"[6].

It is recorded that he "had served the Hon'ble Company without intermission of furlo' for 40 years"[7]. His wife had returned to England before his death on account of her health[8].

FRANCKLIN, William. Ben. Inf.
b. 1763. d. 12–4–39.

Ens. 31–1–1783 ... Lt Col. 16–12–14; invd. 1–10–15; ret. Dec. 1825.

Son of Rev. Thos. Francklin, vicar of Ware 1759–77 (*DNB.* & *OW.* I, 349).

m., Calcutta, 9–3–01, Marian Hastings, dau. of Dr. James Collie.

ed. Westminister; *DNB.*; *DIB.*; Hodson, II (13–4). *OW.* I (349).

1786, travelled thro' Persia, inscribing his name on Persepolis gateway, 1787 [000][9].

1793–4, on escort duty with Charles Reynolds [I, 310–2], and again with James Mouat, 1795–6 [I, 56].

Benares, June 1802, complied a sketch of Hariāna from material supplied by George Thomas [57].

1812 till retirement, Regulating Officer, Bhāgalpur; Nov. 1814 to March 1815, survd. Chandan R. from source near Deoghar to junction with Ganges at Bhāgalpur. Compiled map of Jungleterry Dist., now Santāl Parganas, showing his marches 1813–20[10].

Author of *Observations made on a tour from Bengal to Persia*, 1786–7; pub. 1790—*History of the Reign of Shah-Aulum, 1798*; repr., Allahābād, 1915—*Journal of a Route from Rajemehal to Gour, 1810–11*; 1812—*The Military Memoirs of Mr. George Thomas*; London, 1805.

Prominent member of ASB.

FRANKLIN, James. Ben. Cav.
bapt. 6–5–1783. d. 31–8–34.

Corn. 26–3–06 ... Maj. 7–7–33.

Son of Willingham and Hannah Franklin, and bro. to Sir John Franklin [1786–1847] RN., FRS., the arctic explorer.

m., Cawnpore, 7–4–18, Margaret Maria Clements, dau. of Gen. Sir Thos. Brown [51].

EIMC. III (97); Hodson, II (214).

On voyage to India, 1805, took part in capture of Cape of Good Hope.

"BMC. 23–1–10 (72), appd. Sec. to Col. Martindell & "Postmaster to the Troops" in Bundelkhand; 1811, survd. routes of Lt Col. Brown's dett. [51]. His maps are well drawn, and one of them, MRIO. 81 (8), has as title-piece a neat little sketch of Kālinjar Fort.

[1] Ben. Inf. 1807; resd. in India 1824; d. 10–8–32, in his pinnace nr. Budge Budge (Hodson). [2] best respects. [3] DDn. 130 (65), 22–8–13. [4] ib. (69), 11–9–13. [5] ib. (25), 13–7–13. [6] DDn. 156 (136), 12–8–18; 147 (150), 17–8–18. [7] *Govt. Gaz.* 9–7–18. [8] Ben. Wills, 1818. [9] Curzon, II (157). [10] MRIO. 164 (10); Misc. 1–0–1775.

16–10–13, appd. survr. of S. frontier of Bundelkhand [6, 51–2, 312] ; "In October 1813 I was ordered to survey the frontier line of the British possessions in Bundelcund, beginning at Gurgurh and ending at the Chumbul River. I was then on service with the Army before the fort of Alwar, and could not commence my labours until January 1814". Writes to SG., Rewāri, 11–11–13 ; "Colonel Brown has nominated me, and Major General Marshall has appointed me, Major of Brigade to the Cavalry in Camp"[1].

Interrupted by the Marātha War, Franklin continued svys. in Bundelkhand till 1819, tying them together by rough trgn., and producing a very valuable map [193, 201, 230, 231, 312].

FRASER, James Baillie. Traveller & Author. b. 11–6–1783. d. Jan. 1856.

Son of Edward Satchell & Jane Fraser, of co. Inverness ; bro. to Wm. Fraser, BCS. [*inf*] and to G. J. Fraser (1800–42), Ben. Cav., and rev. survr.

DNB. ; *DIB.* ; Murray, II (430–8).

1815, visited his bro. Wm., who was on pol. duty in Sirmūr [*inf*]. Left Delhi 9–3–15, reaching Nāhan 14–3–15, in time for successful close of Ochterlony's campaign in Sirmūr [89–90]. Accd. his bro. on tour to Sutlej valley ; on return journey, whilst Wm. returned to Srinagar, James ascended to the source of the Jumna, and then crossed to the Bhāgīrathi valley which he ascended to Gangotri, being the first European to do so [78].

Tho' no survr., made a rough map of the area and, being a capable artist, made a series of interesting pictures of mountain scenery, including spirited views of troops in action against the Gurkhas at Malaun and elsewhere. These were pubd. 1820, as a set of 20 or 24 aquatints, under title *Views in the Himalaya Mountains* ; VM. exbts. 2014–33[2].

1824, pubd. another series of aquatint *Views in Calcutta*, VM. exbts. 1671–84.

1821, travelled in Persia ; 1833–34, further travels to Constantinople & Persia.

Auth. of *Account of a Journey to the Sources of the Jumna and Bhagirathi Rivers*, with alternative title *Journal of a Tour through part of the Snowy Range of the Himalaya Mountains, and to the Sources of the Rivers Jumna and Ganges*[3].

Referred to in Burne's *Bokhara*, I (15), as the "well-known author of the Kuzzilbash" ; wrote a *Military Memoir of Lt Col. James Skinner* [364 n.4], 1851, and also some fiction.

William Fraser (1784–1835), his brother, had been Sec. to Ochterlony at Delhi, 1805, and Sec. to Elphinstone on mission to Peshāwar, 1809 [65–6]. As 1st Asst. to Resdt. at Delhi was attd. to Gillespie's column that entered the Dūn, Oct. 1814, and his "zeal for the Service induced him to accompany ...the Assault of Kalunga, on which occasion he was wounded by an arrow [in his throat], participating in the danger of the Troops [90]"[4].

It had been ordered "that Mr. Fraser should accompany the Detachments to be employed in the occupation of Deyrah Doon, and of the valley and capital of Sreenagur, for the purpose of assuming the management of the Country which may be conquered by the British arms, and of aiding Maj Gen. Gillespie in any communications which he may have occasion to hold with the Chiefs and Inhabitants"[5].

March 1815, reports ; "It occurred to me that 10 or 14 days might be usefully employed in visiting the interior, to acquire a degree of local knowledge, and if possible to make arrangements for future operations. With this view I left the advanced camp at Nownee on the 5th inst. ...accompanied by Ens. Blane, of the Engineers, towards Joobul [90, 383]. I passed the Snowy Ridge of the Chory range [pl. 10] on the 9th, and reached Surai in Jubul"[6].

May 18th ; "From hence I shall proceed to, and visit, all the intermediate tracts between the N.W. point of the Choor range of Mountains, the Palur River, and the countries of Bischur[7]. ... The inhabitants of the Hilly regions are warmly interested in the cause. ... Since the commencement of this letter, the Chiefs of Bischur have visited me and accorded their devotion and attachment to the British Government"[8].

1819, in ch. settlement of Garhwāl ; 1827–30, as member of Rev. Bd. at Delhi, held control of rev. svys. of Upper Provinces. 1830, appd. AGG. Delhi, being assassinated there, 22–3–35. Portrait, *Delhi Records* (191) ; MI., St. James' chyd. Delhi.

FREDERICK, Edward. Bo. Inf. b. 23–6–1784, Bombay. d. 1866.

Lieut. 26–5–1800 ... Bt Col. 1–12–29.

Son of Charles Frederick (1748–91), RE. & Bo., Inf., [I, 128], and Martha, his wife.

CB.

1809–10, with Malcolm to Persia ; May 1810, appd. supernumerary Asst. at Shirāz, and sent to investigate circumstances of Grant's death[9], submitting map of his route [175, 339, 403].

Not to be confused with his bro., Lennox John Frederick, Bo. Engrs. ; ens. 1809 ; Capt. 1821 ; d., Bombay, 1832, who made a small chart of Core Hassan in Persian Gulf, before 1810 ; MRIO. 101 (16).

FYFE, John. Mad. Inf. bapt. 28–12–1789. d. 17–11–30, at sea.

Lieut. 22–10–06 ... Capt. 10–6–20.

Son of Capt. James Fyfe & Dolly McGrigor his wife, of co. Banff.

m., 6–10–21, Miss Armstrong, sister of Gen. Edward Armstrong.

June 1807, MMI., cl. III [320] ; 1809–10, on Kālahasti svy. under Garling [127], and with him to Goa, being reverted to his unit, Sept. 1811 [156 n.5].

Later, Resdt. Tanjore.

GACOIN, Michel Pierre. b. *c.* 1754. d. 12–10–18, Delhi.

Chevalier de l'Arquebuse de St. Malo en Bretagne, France[10].

From about 1754 in service of the Rāja of Jaipur and other chiefs ; came to Cawnpore, 1800, and arrested by British, to whom he presented his sketches of various routes W. of Jumna, made since 1797, taken with a few astr. obsns. [57–8] and a map stretching from Surat to Lahore and Lucknow.

Visited Calcutta 1802, and returned Delhi 1803–4, making svys. along Jumna as far as Siwaliks [82] ; for these maps and svys. Govt. granted him gratuities.

[1] DDn. 130 (101). [2] eng. by R. Havell & pubd. by Messrs. Rodwell & Martin, Bond St., March 3rd. 1820. [3] *As R.* XIII, 1820 (171–249) ; reviewed, *Cal. Rev.* IV (162). [4] BSC. 29–11–14 (16). [5] ib. 6–12–14 (77). [6] ib. 18–4–15 (42). [7] Basshahr ; Upper Sutlej valley. [8] BSC. 9–8–15 (22). [9] Journal, 18–5– to 10–9–10 ; DDn. 270 (43). [10] Designation given in letter of 28–4–04, describing journey up and down Jumna ; BM Addl MS. 13523 (56).

Settled at Delhi where he had a small house, and was well known. His obsn. of lat. at Delhi, 3–4–06, is preserved in the original French, DDn. 40. His offer to explore Ganges above Hardwār came to nothing [73][1].

B Pol C. 12–9–09, Resdt. at Delhi was authorised to pay him Rs. 2,228 for "repairs to the well at the Jumma Musjid".

ib. 28–11–09 (15), Resdt. reports that repair of the damage to palace gates sustained on July 24th "have been completed in a style even superior to the original workmanship, and that the sum of Rs. 4,592–12 only has been expended. I owe it to justice and to Monsieur Gacoin to declare that the Saving is solely to be attributed to a most conscientious discharge, on his part, of the duty which he undertook to perform.

"He himself looked into every detail. With his own hands he made the moulds and cast the beautiful brass flowers with which the gates are covered, and by minute examination of the old materials, he found that some articles which he at first believed to be unserviceable were capable of being converted to use.

"Repairing the Great Gates of the Fort of Delhi, which are from 19 to 21 feet high, and from 13 to 14 broad". Commenced 26–7–09.

GARDEN, William. Ben. Inf.
bapt. 8–3–1790. d. 29–7–52.

Ens. 29–11–13 ... Bt Col. 2–8–50.

Son of Alexander Garden and Grizel, dau. of Alexr. McCombie, his wife.

CB. ; ADC.

Hodson, II (246)

BGO. 14–10–14, appd. Asst. on svy. of Chittagong [19] ; withdrawn, BMC. 28–1–15 (94), "to join his corps for the field...which has but four European officers, besides the Commandant".

Later had useful career as survr. in QMG.'s dept. ; QMG. 1841–50.

GARLING, James. Mad. Inf.
b. 16–5–1784. d. 4–8–20, Hyderābād, of cholera.

Lieut. 21–9–04 ; Bt Capt. 1–1–18.

Son of John Frederick & Caroline Garling of London.

April 1805, MMI., cl. I [320] ; April 1806, appd. Asst. Instr. on 50 *ps.* pm., being allowed a further 25 in the field.

Riddell writes ; "He was appointed to the first class, ... I to the 2nd. ... On the increase of the Institution to two classes, Capt. Troyer selected him as an assistant, and he read Capt. Troyer's lectures to our class, which, highly fitted for the purpose as they no doubt were, were simple and elementary in the extreme, and could scarcely be considered as teaching the elements of surveying to one who had gone thro' a regular and academical course of mathematics and Trigonometry. I mean not to deny Garling's merit, but...as well might the boy who performs his important, no doubt, but mechanical task in the system of education introduced by Lancaster[2], claim the merit of having initiated his school-fellows in the paths of science, as Lieut. Garling of having instructed the 2nd Class of the Military Institution. He read Capt. Troyer's lectures no doubt, but he taught himself while conducting instruction to others" [125–6, 316, 319, 332][3].

Nov. 1808 to April 1809, with Malcolm in Bombay, employed on mapping [131, 280].

Dec. 1809, recdd. for independent ch. of dett. of students, extending Lambton's triangles to Kālahasti and Tirupati, 60 m. N. of Madras [4, 127, 215, 347, 371 ; pls. 12, 16]. "This officer has lately received from England, at his own expence, a large Theodolite similar to that...employed by Major Lambton [231, 253, 255], and his attainments...qualify him to conduct a Trigonometrical survey on the principles observed in Major Lambton's operations"[4].

Nov. 1810, marched his party across India to undertake svy. of Goa, which he completed by Jan. 1813 [2, 156–8, 164, 194, 229, 314], and then took up the svy. of Sonda or N. Kanara, after completing which he returned to Madras in Sept. 1815 [130, 158–9, 216, 248, 358, 363]. His trgn. was accepted by Lambton as fit for incorporation with that of his General or trig. svy. [3, 158, 246, 347].

From 1816 till death held ch. of the svy. of Nizām's dominions.

GARRARD, William. Mad. Engrs.
bapt. 6–1–1780. d. 2–9–36, Ootacamund.

Ens. 7–8–97 ... Col. 1–12–29.

Son of William & Ann Garrard, of Reading.

m., Lambourn, Berks., July 1806, Martha Francis ; their eldest dau. Eliza m., 27–9–40, Henry Garnet Man of HM. 54th Foot.

Mysore War, 1799 ; attd. to Nizām's Subsy. Force under Mackenzie on march to Seringapatam [I, 118] ; "their oridinary duties were to survey every day's line of march and encampment, and regularly to prepare, immediately after coming on the ground, and furnish to the Commanding Officer, drawings of the same ; including the relative positions of the Head Quarter flag of the Grand Army ; and to superintend the removal of all obstructions, whether to the march, or to the Free communication between the two camps" [I, 350–1][5].

1813, prepared svy. traverse tables, adopted by SG. [217], and pubd., Calcutta, 1816 and 1827 under title "*Trigonometrical Tables...*".

GARSTIN, Edward. Ben. Engrs.
b. 6–2–1794, Chunār[6]. d. 13–7–71, Bangalore.

Ens. 6–5–15 ... Gen. 1–3–67, the first Engr. officer to become General or Col. Com.lt[7].

2nd son of John Garstin [*inf*].

m., Calcutta, 26–7–36, Mary Anne, dau. of Adam Duffin.

Hodson, II (252–3).

Nepāl War, Sept. 1814, appd. with another Engr. cadet, Paton, as asst. survr. Hodgson writes on his way up the river, 16–10–14 ; "The young gentlemen are somewhere ahead, but I have not seen them. I heard indeed much of them at Berhampour, how that they were the most wonderful prodigies of Learning & Ability that had ever visited these Eastern Regions, & General Garstin assured all the people there that the operations of the wonderful youths will quite astonish the world. ... What is to be done with them if I go on the River Survey ? I can very well dispense with their assistance [41]"[8].

Young Garstin made several route svys. along Nepāl frontier during campaign of 1814–5 [42]. In pressing for allces., he writes later ; "From the period of Capt. Hodgson's joining the Army in the Field under the command of Maj. Gen. Marley, the operations of the Survey were not confined to the movements of that Army. ... The Brigade to which I was attached[9]...was, and continued to be, on active service in advance of Nautpoor, and...it was not till the 2nd of June that I was able to quit that Detachment, ... and...I then continued out doing full Surveyor's work (and which I had done from March 1815)...until the 2nd June,

[1] Colebrooke to White, DDn. 81 (61), 20–2–07. [2] Joseph Lancaster (1778–1838) ; pubd. 1803, *Improvements in Education ; DNB.* [3] DDn. 151 (129), 9–2–18. [4] from QMG., 22–12–09 ; MMC. 2–1–10. [5] *EIMC.* III (377). [6] *CG.* 20–2–94. [7] Thackeray. [8] DDn. 136. [9] Gregory's Bde. [389 n.4] ; Fdbk. M 334.

when from ill-health and bad weather I was forced to leave off the field part, tho' I continued constantly employed...in Drawing the Plans belonging to it"[1] [223, 312].

At the end of 1815, posted to Hodgson's svy. in the Simla Hills, resigning the following year.

GARSTIN, John. Ben. Engrs.
b. 1756. d. 16–2–20, Calcutta ; MI. S. Park, St. cem.

Ens. 1778 ... M Gen. 4–6–11.
SG. Bengal, 1808–13.

Son of Margaret Garstin of Half Moon St., Piccadilly, who had another son, Edward, who m. Mary—and d. 1779, leaving a son, b. 19–8–1779, Edward John James, nephew to the SG. Margaret d., a widow, in Savoy Precincts[2].

Claims kinship with Robert Colebrooke [391], which which accords with tradition in both families, pointing to an irregular connection. Connection with Braganstoun family, co. Louth, not proved.

m., Dinapore, 21–11–1789, Mary, dau. of Rev. John Loftie, Ben. chpn. ; she d., Calcutta, 28–7–11, and "only grieved her husband when she died" ; MI. S. Park St. cem.

Father of Alfred, Ben. Cav.—Edward [*sup*]—and 5 other children, of whom Charlotte m., Calcutta, 26–8–14, James Charles Colebrooke Sutherland, grandson of Sir Geo. Colebrooke, Bart. [I, 326].

DIB.; Hodson, II (253–4); Portrait (pl. 20) from oil painting by Opie in possession of family[3].

Country cadet, 1778.

1780, examined navigability of Cossimbāzār R. above Murshidābād [I, 63].

Before 1784, employed on large-scale plan of Calcutta with other Engr. officers [I, 52–3 ; II, 18].

1784–6, stationed at Patna, drawing survrs'. allces. till March 1785, and employed on construction of Granary, or *gola*, at Bankipore.

"This structure, consisting of a brick building in shape of a bee-hive[4], was [erected] as a storehouse for grain, as part of a plan to guard against famine, the intention being to build such granaries at various points. ... The granary at Bankipore was never filled ; ... it is an enormous structure ; the Walls are 12 feet thick. Two spiral flights of stairs (outside) lead to the top where is an opening for filling in the grain. ... Over one of the doors is a marble tablet with the following inscription ; 'In part of a general plan ordered by the Governor General in Council, January 20th 1784, for the perpetual prevention of famine in these provinces[5], the granary was erected by Capt. John Garstin, Engineer'. ... The Gola has never been filled, and the close of the inscription remains blank ; the building stands a useless monument of a mistake, inasmuch as the doors at the bottom open inwards. There was a Granary built at Fort William under the same order"[6].

Another account records that "it is famous for the wonderful echo, the slightest movement or sound being repeated a hundred fold".

The following is taken from Garstin's completion report, 4–10–1786 ; "The Granary ordered...on the 20th Jany. 1784, and...entrusted to my care, is completed. The Dome was closed in the month of December last, and from the uncommon Heats of the Season, it is much drier than would be expected, and will I think be sufficiently so to receive Grain after the hot Winds of the next year have blown thro' it.

"The Dimensions of the Building are rather larger than those laid down in the Plan, which I attribute to the stretching of the chain, a circumstance that could not be foreseen, or if it had could not have been prevented without risquing their being diminshed. The difference is but trifling, being in the interior Diameter 108 Feet instead of 107–6, and in the interior height 94 Feet instead of 93⅛. ... From the most accurate measurement, and from the quantity of the Materials used in the Building, I find the solid contents to be as follows :

Floor and Foundation ...	...	1,06,897·83
The Foundation [of Walls ?]	...	49,597·84
The Roof of the Dome	...	2,87,630·30
The Spiral Stairs & Parrapett	...	10,120·00
Solid Feet	...	4,54,245·97

"The sum of Money what has been expended in the Erection of this Building amounts to Rs. 1,59,672-14-3, besides the 10% allowed me for my labour, which makes the total Rs. 1,75,640-2-10, which sum I have at different times received, giving my Receipts for the same.

"The labour required to carry the Materials up so great a Height, and the Number of Workmen necessary to cut, rub, and fit the Bricks to the Bevels...being considered, I trust the charge will be found to be uncommonly Moderate"[7].

Many rude remarks have been passed on this famous building[8], which is now protected as an *ancient monument*, and Garstin has been ridiculed for making the doors open inwards. He had, however, nothing whatever to do with the design, which was worked out by the CE. at Ft. Wm., presumably Henry Watson [I, 394]. On the other hand his completion report, quoted above, accepted the building, as constructed, as perfectly satisfactory and ready to receive grain !

Lord Moira gives the following description ; "Aug. 13th 1814. ... This is a brick building, rising as a dome, constructed by order of Mr. Hastings as one of many receptacles for grain which he meditated establishing with the view of guarding against famine. This building seems admirably calculated for the purpose. ... Four doors, on a level with the ground, afforded facility for taking out the grain[9]. ... No second Gola has been built, and no grain has ever been lodged in this one"[10].

Reuben Burrow obsd. astr. position of the *gola* in 1787 and 1789, whilst staying with Garstin [I, 161].

Garstin remained at Patna till 1793, when he was tr. to ch. of works at Chunār, where Edward was born. Before leaving Patna his household was involved in a case of breach of promise of marriage that appeared before the Supreme Court, and is fully reported in the *Calcutta Gaz.* of 24–1–93. Garstin himself was one of the chief witnesses for the prosecution. The plaintiff was Miss Barbara Loftie, his wife's sister, who "was living at his house at Bankypore near Patna in April 1791, when she first saw and became acquainted with the Defendant. In July of the same year, Miss Hunter, sister of the Defendant, came to live in Captain Garstin's family, and continued there till February 1792, when her brother was appointed a Judge of the Court of Circuit in Behar". The defendant, William Hunter, a civilian and Judge, was an obvious catch, and Barbara won the sympathy and verdict of the Supreme Court and its jury, to the tune of Rs. 20,000.

With this dowry she m. Martin Fitzgerald, of the 10th Ben. Lt. Cav., and amongst her sons were John (1796–1851), of 2nd Ben. Lt. Cav., and Wm. Robert (1797–1844), Ben. Engrs., who made some useful svys. She d., Bath, 2–4–47.

Dec. 1797, Garstin moved from Chunār to the presdcy. "to prepare to go to Europe for the benefit of his Health", and he sailed with his family 5–3–1798. On return he was employed at Ft. Wm. ; 1804, "travelled to & from Cuttack during the Hot Season", and put up proposals for a trunk road from Calcutta [24–5][11].

[1] BMC. 15–11–16 (70). [2] Somerset Ho. will, PPC. Webster, proved 16–8–1781. [3] SGO. file 111 (1925) ; *cf. Ben P & P.* LII. July 1936 ; *Records, S of I.* XIII, 1917–18. [4] Plan & Section, BM. K 115 (48, e, f). [5] The erection of grain-elevators was proposed after Bengal famine, 1944. [6] *Ben P & P.* II (288–9); but cf. n.9 [*inf*]. [7] BPC. 31–10–1786 (32). [8] *v.* Archer (115). [9] Nothing here about inward opening. [10] Hastings' *Journal* (53). [11] DDn. 81 (167), 14–12–09.

1807, took over ch. of the SG.'s drawing office when Colebrooke went on svy. up-country [29]. The same year he was entrusted with the building of the Town Hall. We find advts., 1792, calling for subscriptions "for the Erection of a Public Building for the General Accomodation of the Settlement", and "for suitable designs and estimates ; Building should be well adapted to the Climate, and contain a spacious Ball Room, Concert Room, Dining Rooms, Card Rooms, Dressing Rooms, and other convenient and necessary apartments, ... suitable Offices ; separate Entrances for Palanqueens and Carriages, with detached Sheds for them and for Horses". By Dec. subscriptions had reached Rs. 31,168, including Rs. 1,000 from Mark Wood [I, 397–8] and Rs. 300 from Wm. Kirkpatrick [I, 344–5][1].

Ben P & P. VII (181) records that "Funds for the construction of the Town Hall...were raised by public lotterries, and sufficient funds for a commencement having accumulated in 1806, plans and estimates were sanctioned in 1807,[2] and Colonel John Garstin, the Chief Engineer, was entrusted with the construction of it. The building was commenced on 1st December 1807, and completed in 1813. ... Towards the beginning of 1815 apprehensions were entertained in regard to the safety of the building, owing to the great spring in the boarded floor of the second storey caused by the beams having been placed at considerable distances from each other. ... Nothing was done till 1818, when it was discovered that several of the pillars in the upper hall had suffered injury, in consequence of their having been built of bad materials. Accordingly the building was put in thorough repair in 1818–9 ; the pillars in question were re-erected, and additional beams introduced under the boarded floor. The expense of re-erecting the pillars was borne by Col. Garstin according to the terms of the agreement".

A marble slab in the plinth describes Garstin as the architect. The reconstruction above described was not his only extra expense, for at the end of 1809 the front portico had collapsed. He writes to Webb, 25–1–10 ; "When your letter of the 4th of January reached me, I was suffering under a dreadful misfortune, viz., the fall of the Noble Portico of the Town Hall the very day after the Building was finished. Although very great precautions were taken to render them secure, and that I took upon myself to make them 12 feet wide instead of eight, yet the foundations gave way. No blame is imputed to any one, and I hope soon to get the business settled. The portico must be rebuilt, and more expense incurred to render them substantial"[3].

Sackville writes, 13–1–10, to condole ; "I hear that a great part of the front, and that the whole of the pillars have given way, and that your loss must be in consequence incalculable. However disagreeable such a circumstance of itself must be, still there is great satisfaction in hearing people attribute it to the right source. I understand...that the whole of this misfortune has entirely been occasioned from the badness of the soil, an unavoidable reason of itself, and that you have to thank the confined ideas and parsimonious dealings of the committee in not having allowed a stock sufficient to have formed a foundation in proportion to the soil and weight of so expensive and substantial a building. Pray let me hear your opinion, ... as I shall be better satisfied with your remarks on the subject than of any other. I wish to God you had allowed them to make their own job of it. ... I feel some pleasure in knowing that you will take things as they happen in their real, not in their apparent, light, and will avoid allowing yourself more vexation than the subject requires"[4].

Garstin replied, 25–1–10, "That the whole of the portico of the Town Hall fell is as certain as that it was built, and the dreadful violence and weight of the fall shook the whole building, and occasioned several of the walls to settle and, as they did so unequally, large cracks in several directions appeared, & for ten days continued to widen. I believe the whole has now come to its bearings, and have not a doubt but, at a considerable expence, it can, and will, be made absolutely as perfect as any edifice in the world[5].

"It is true that if more money had been given, and that on the full representation I made of the badness of the soil the Commissioners had been willing to have spared no expense, this might have been avoided, but no blame attaches to a set of Gentlemen who, not being professional men, looked out for, and took, what in their opinion appeared to be the best advice they could obtain. ... The committee of Survey have been told the truth, the whole truth, and declared that there had been no neglect or want of foresight, and that it is impossible to use better materials or make finer work. I hope and trust they will exonerate me, and if they do I will easily apply a remedy to the misfortune.

"Colonel Kyd is gone ; I expect to take the Command tomorrow, and hope to get on in spite of misfortune"[6].

Garstin had been acting CE. during 1806–7 when he took ch. of the SGO. for Colebrooke [296, 297, 387], and on the latter's death succeeded as SG., holding both appts. after Kyd's departure, until Crawford was made SG. in April 1813 [5, 55, 192, 218–9, 222, 230, 270, 273, 281, 295, 310–1, 324, 328].

He writes to Webb, 7–6–09 ; "I have been lately much troubled with the stone, and a violent fit of it disabled me from stooping to the Desk, which threw my business much in arrear ; though better, I have not yet recovered my strength ; this renders me desirous of making an exertion whenever I may have the power"[7].

Later in the year he appears to have travelled up to the NW. frontier, possibly to advise on defences, for Hodgson writes, 15–11–09 ; "I hope you had a pleasant journey down, and are in good health", and refers to a svy. Garstin had just been making of the fort at Ludhiāna [64][8].

In March 1810 he writes to Sackville ; "I expect to be ordered to Saugur, and to report on the Light House at Kedgeree, a very disagreeable duty, the marine people saying it is absolutely useless" [11, 15, 24, 419]. Again, "I have had many letters from Europe ; private news agreeable, public very bad"[9].

31–5–10, writes to White ; "I am so unwell as scarcely to be able to write", and to Govt., 2–10–11 ; "A severe indisposition, attended with great numbness in my Hands and Feet, has for nearly three months prevented my writing or giving the attention to business I am always desirous of shewing"[10].

Lady Nugent, wife of the C-in-C. [23, 409], makes several references to Garstin in her interesting Journal ;—"March 18th 1812. Among my visitors this morning was a General Garstin who bored me sadly, and I thought I should never get rid of him".

May 8th. ... Dined at General Garstin's. ... June 30th. ... Sent an excuse to General Garstin".

July 1st. starts river journey up country ; describing the Bankipore *gola* ; returns to Calcutta, 1–8–13 [23].

"Sept. 3rd 1813. ... All our Staff dined with General Garstin. We were alone. ... March 3rd 1814. ... General Garstin's Dinner ; ... a large evening party".

Lady Nugent also notes that on "Oct. 10th. In the evening, Mr. Chestney (a natural son of Lord Holland's) dined with us"[11].

Dec. 1812, Garstin recommended a cut between the Ganges and Cossimbāzār rivers, as a possible

[1] *CG* 8–6– ; 9–8– ; 13–12–92. [2] Total cost about 7 lakhs ; Smyth (59). [3] DDn. 81 (200–1). [4] DDn. 82 (70–4). [5] The town hall is still standing, 1945, in good order, as Garstin left it 1820. [6] Kyd was CE. from Dec. 1807 to Jan. 1810 [I, 347]. DDn. 81 (198). [7] ib. (121). [8] DDn. 82 (53). [9] DDn. 126 (2), 20–3–10. [10] ib. (10). [11] Nugent, I (121, etc.).

means of preventing the flooding of Murshidābād [21].

BGO. 21–1–15 & 3–2–15; being granted furl. on mc., Garstin embarked 3–2–15. *CG.* 26–1–15; "For Sale. Elegant and valuable Property to be sold by Public Auction at his Quarters in Fort William...of Maj. Genl. J. Garstin of the Engineers, proceeding to Europe. Plate—Cut-Glass Ware—Mathematical, Drawing & other Instruments—Carriage and Pair, Palanqueens, Tonjons, etc.".

CD to B., 22–4–18 (4), permitted to return; sailed as passenger by *Warren Hastings* with Miss Julia Garstin and Miss Colebrooke[1]; arrd. Calcutta 15–9–18; BGO. 2–10–18, resumed comd. of Engr. Dept. and seat on Mil. Bd., holding office till death.

Govt. Gaz., 15–10–18; "Maj. Genl. Garstin has translated & published Frisi's[2] Treatise on Rivers and Torrents, with the method of regulating their course and channells, and also an essay on navigable Canals. Maj. Genl. Garstin visited Italy that he might examine on the spot the general accuracy of the leading statements of the original work".

A friend and protégé of Warren Hastings, the family holding two letters written by him when staying with Hastings at Daylesford, Glouc.s.

His name is preserved in Calcutta by Garstin's Place, a cul-de-sac opening out of Hare Street.

GERARD, Alexander. Ben. Inf.
b. 17–2–1792. d., Aberdeen, 15–12–39.

Ens. 9–9–08 ... Capt. 13–5–25; ret. 15–2–36.

Son of Gilbert Gerard, DD., of King's College, Aberdeen, and Helen his wife, dau. of John Duncan, provost of Aberdeen.

Bro. of Patrick, Ben. Inf. (*DIB.*) and of James Gilbert, Ben. Med. (*DNB.*; *DIB.*); nephew of John (1765–1824), Ben. Inf. [I, 337].

DNB.; *DIB.*; Hodson, II (259).

1812, Jan.–Feb., survd. route with Ochterlony to Lahore and back; Oct.–Nov., survd. route Ludhiāna to Bareilly [65].

BGO. 21–10–14, appd. to rev. svy. in Sahāranpur under Bd. of Comnrs., having commenced 12–1–14; withdrawn for mil. service 6–1–15 [7, 180, 312].

Further services as survr. and explorer described in next vol.

GILBERT, William. Bo. Inf.
b. 5–2–1781. d. 5–11–66.

Ens. 20–1–1797 ... M Gen. 10–1–37.

Son of Joseph Gilbert.

1813–7, on svy. of forests, Kanara [168].

GODBY, Christopher. Ben. Inf.
b. 28–1–1790. d. 8–12–67.

Ens. 31–7–06 ... Lt Gen. 22–11–62.

Son of Charles and Grace Godby of London.

m., Calcutta, 24–6–20, Frances Barbara, 3rd dau. of Jacob Vanrenen, Ben. Inf.[3]; She d. 1886 aged 86.

CB. 1846; ADC. Hodson, II (277).

BS & Pol. 23–5–15 (19), prepared "Map of a Route to Katmandoo thro' the Seedly Pass", from material collected by Magte., Tirhut.

GOLDINGHAM, John [I, 337–8]. Company's Astronomer, Madras.
d. 1849.

m., 1st., Madras, 20–4–1796, Miss Louisa Maria Popham.
2nd., Madras, 20–2–15, Miss Anne Baxter.

A son, John (1801–86), MCS., ret. from M Rev Bd. 1860; another son, George, (1805–31) was Lieut. Mad. Art.

His dau. Harriot Marion, m. Edward Lake (1798–1830), Mad. Engrs., auth. of *Sieges of the Madras Army.*

15–1–1788, asst. to Topping [I, 171–4]; 5–2–1796, Astronomer; 6–2–05, leave England; 31–1–12, resumed office, Madras; 1830, ret.

Also held office as Supdt. Survg. School—Inspector of Rev. Svys.—and Mar. Survr. [2, 190, 195–6].

FRS.; portrait by John Smart junr. 1808.

MPC. Nov. 1804, Applied for leave to England [299–300], mc. certifying that he "has at different times during the last three years had occasion to consult me for a complaint in his Bowels proceeding...from a diseased state of the Liver, brought on by a violent inflamation of that organ several years ago. ... This complaint, tho' seldom so urgent as to confine him to his room, or prevent him from following ordinary occupations, has been gradually getting worse, particularly during the last two rainy seasons".

Feb. 1805, granted leave to England, nominally for 3 years, but absent till March 1811, when permitted by Directors "to return to Madras to resume the charge of the Observatory, a situation for which they deem you peculiarly qualified; but you are not to interfere with the Engineer Department in any manner whatever"[4].

Dec. 1811, arrd. Calcutta, thence to Madras to resume ch. of obsy., 17–2–12, with former salary of 192 *ps.* pm. [I, 280], "but with no other duties beyond that of Astronomer", as the training and supervision of survrs. was now vested in SG. [196]. In 1814, however, he was appd. Supdt. of the Male Asylum on salary Rs. 150 pm., as well as Inspector of Govt. Press and Editor of *Govt. Gaz.*, for which duties he drew a further Rs. 100 pm.

1821–2, led expn. to Sumatra and adjacent islands to determine length of seconds pendulum on the equator; pubd., 1826, *Report*[5] "*together with a deduction of the Figure of the Earth, by combining the Equator, Madras, and London Experiments*", with a full account of expn.[6]

Feb. 1827, granted leave to England for recovery of health, and allowed 1,000 *ps.* a year for three years, though pension refused[7].

RAS. (*mn*) X. 1850 (80); "John Goldingham Esq. is known to science by his long occupation of the post of Astronomer at Madras. ... As Astronomer he published two volumes of observations of the length of the pendulum, of the velocity of sound, of meteorological phenomena, as well as determination of the longitude of Madras, and a discussion of the longitudes of the three Presidencies [I, 180–1; 386]. ... It does not appear that Mr. Goldingham was much in communication with European Astronomers during the active part of his Indian life; and to the want of such a point of union then as is now afforded by our Society, it is perhaps to be attributed that no continuous astronomical effort, no regular series of observations, appear to have been made by him".

GOODALL, Thomas. Ben. Inf.
b. 1781. d. 26–8–06, Agra.

Ens. 8–10–1799; Lieut. 26–8–06.

Hodson, II (282–3).

[1] Either Frances or Emma [386]. [2] Paolo Frisi (1728–1784) pubd. *Treatise* 1762, Lucca; *Ency. Brit.* [3] G father of D. C. and A. D. Vanrenen, rev. survrs. *v. A Notable Record*; E. Joubert De la Ferté, London 1926. [4] Had been civ. engr. Madras, 1800–1 [I, 338]; DDn. 127 (180), 25–10–11. [5] GBO. Lib. Ff. 126. [6] *RAS.* I. 1826 (549). [7] 1,000 *Pagodas* = £ 350 [I, 278 n.7]; Com Cor. 18–1–28.

May 1806, survd. route of 4th NI., comdd. by Chas. Crawford [392–3], from "Badawas[1] to Agra, with Col. Ball's dett."

GOODFELLOW, Samuel. Bo. Engrs.
b. 5–7–1774. d. 14–6–60.

Ens. 20–1–1797 ... Gen. 1859.

Son of Samuel & Ann Goodfellow, of London.

m., Ahmednagar, May 1805, Charlotte Anne, dau. of Lt Col. John Capon, Bo. Inf.

Oriental Club.

1799, Mysore War; 1801, with Baird to Egypt [393]; 1803, Marātha War, comdg. pontoon train; then, Bo GO. 5–4–03, on svy. Mazagaon Estate, Bombay [185–6].

BSC. 16–5–05 (236), on svy. of "line of communication" between Poona and Bānkot, Fort Victoria[2], on W. coast. Bo GO. 5–6–07, appd. asst. to Johnson on svy. of forests in Kanara, and succd. to ch. [167].

MGO. 26–5–09, supervised work of officers of MMI. at Bombay, Nov. 1808 to March 1809, drawing map of Persia for Malcolm [131, 280].

GORDON, Robert. Bo. Engrs.
b. 2–4–1786. d. 7–8–34, Bombay.

Ens. 1–5–04 ... Maj. 20–2–31.

Son of Rev. Lewis Gordon, minister of Drainie, Elgin, & Elizabeth Logan his wife.

m., Calcutta, 13–3–16, Finella Davidson, widow of Hugh McPherson.

1805, survd. routes of Poona Subsy. Force thro' Khāndesh, in ch. of pontoons, via Jamgaon, Nasik, & Ivantbari Ghāt[3] [133].

July 1812, attd. to Pioneers; Oct., appd. asst. to Dickinson on rev. svy. of Bombay [187].

Feb. 1814, tr. to svy. of forests in Malabar, and again to forests in Travancore till end of 1817.

DDn. M 339; possibly survr. of an undated route Gulbarga to Malhāpur[4].

GRANT, Nathaniel Phillip. Ben. Inf.
b. 18–11–1744, New York. d. 15–4–10, kd. by Kurds in Persia.

Ens. 1–9–1800 ... Capt. 19–11–07.

Hodson, II (318).

1806–8, Survd. various routes in Upper Provinces [27].

Jan. to May 1809, survd. route thro' S. Makrān under Malcolm's orders[5] [174]; 1810, sent to Irāq by Malcolm with instructions to find route from Baghdād to Isfahān. His last letter, dated Baghdād, 28–3–10, reported that he had arrd. there on 17th, and meant to start for Isfahān the following day. According to guide who survived, he was held up and murdered by robber band when passing thro' defile he had been warned to avoid. His companion Fotheringham and Armenian servant were shot in cold blood after being taken prisoners [7, 175].

GREENWOOD, Samuel Adam. Bo. Inf.
b. 20–2–1780. d. 21–11–10, Cambay.

Lieut. 30–1–1798 ... Capt. 25–7–05.

Son of John and Frances Greenwood.

Left a nat. son, Charles.

Made svys. in Kathiawar, embodied in Hardy's map of W. Gujarāt, 1807–9, [169].

1810, sen. asst., Baroda Resdcy.

GRINDLAY, Robert Melville. Bo. Inf.
b. 23–10–1786. d. 9–12–77.

Lieut. 1–5–04; Capt. 22–12–17; ret. 20–12–20.

Son of John & Elizabeth Grindlay, of London.

m., 20–7–20, Maria Susanna, dau. of J. W. Commerell of of Hanwell Park, Middlesex.

1809–10, Asst. Survr. W. Gujarāt [171–3, 323].

After ret. founded the banking firm now well known as Grindlay & Co., formerly Leslie & Grindlay, Birchin Lane.

Pubd., 1826, *Scenery, Costumes, & Architecture...western side of India.* 1797–1831; VM. exbt. 915.

HAMILTON, Walter. Mad. Cav.
b. 18–3–1788. d. 6–7–74.

Corn. 7–7–07 ... Maj. 1833/4; ret. 12–4–34; Hon Lt. Col. 28–11–54.

Son of Andrew & Katherine Hamilton, of Edinburgh; 22–1–73, assumed additional surnames of Tyndall-Bruce, of Falkland, co. Fife.

July 1812, MMI., cl. VI [321]; MGO. 18–11–14, appd. Asst. in QMG.'s Dept., svy. branch; 1815, survd. routes in Berār [vol. III].

HANCOCK, Edward Young. Mad. Inf.
bapt. 21–2–1784.

Lieut. 22–11–06; struck off in England, 1816, after 2½ years absence from India.

Son of Benjamin & Mary Hancock.

2/Lt. RM. 8–8–1800; MMC. 29–1–11, "some years in His Majesty's Service".

June 1807, MMI., cl. III [320]; 1810, on Kālahasti svy. under Garling [127]; Nov., survd. route Bangalore to Mangalore; 1811, on Goa svy. [156 n.5, 157 n.3, 399].

HANSON, James. Mad. Inf.
bapt. 29–1–1786. d. 2–2–41.

Lieut. 3–11–05 ... Maj. 15–2–32 ... ret. 31–10–40.

Son of James & Risanna Hanson.

MMC. 29–1–11, "some years with St. Helena Corps".

April 1806, MMI., cl. II [320]; MGO. 13–5–08, leave to St. Helena for 6 months; 1809–10, on svy. with Poona Subsy. Force and nr. Hyderābād [50 n.6, 134].

MGO. 12–3–11, appd. AQMG. with expn. to Java; Sec. to Comdr. of Forces; JMC. 19–8–14, Bde. Maj. W. Div. Java.

1825, DQMG. Madras.

HARDY, Edmund. Bo. Art.
bapt. 11–3–1785. d. 28–2–48.

Lieut. 24–5–04 ... Col. 27–5–33; ret. 25–12–33.

Son of R. Hardy.

m., Bridstow, May 1823, Grace, dau. of Whaley Armitage, of co. Hereford.

EIMC. III (375); *Oriental Club.*

1807–9, survd. routes in Kathiawar, and compiled map [169].

HARE, George. Mad. Inf.
bapt. 26–8–1781. d. 4–5–21, Kulladjee.

Ens. 19–8–1789 ... Maj. 8–4–18.

Son of Rev. Robert & Margaret Hare.

1808, survd. NW. boundary of Ellore Circār [123 n.11].

[1] Bhojawas, 53 D/8 (?). [2] 47 G/1. [3] DDn. 278 (52–3). [4] 56 C/15 to 55 D/1. [5] Journal, *JRAs Soc.*

HARRIOTT, John Staples. Ben. Inf.
bapt. 30–9–1780. d. 11–2–39, Paris.

Ens. 13–10–1797 ... M Gen. 28–6–38.

Son of John Harriott.

m., Brighton, Sept. 1832, Vincenza Ruina Argentini.

Oriental Club. Hodson, II (392–3).

MRIO. M 163, Fdbk., 5th to 23rd April 1801, of route svy. Hyderābād to Nāgpur, via Nirmal, 312 m.; "scarce a Passenger was to be seen on the way".

Marātha War 1803; lost a leg, 1–9–03.

HARRIS, Henry. Mad. Inf.
bapt. 21–3–1789, Madras. d. 1–12–19, Bolarum.

Ens. 7–4–09; Lieut. 5–11–14.

Son of Henry Harris, MD., Mad. Med., & Jane Charles his 1st wife.

July 1812, MMI., cl. VI [321]; 20–6–14, 6 months leave to Java on mc.

HARRIS, Michael John. Mad. Inf.
b. 6–6–1788. d. 9–9–30, Madras, MI.

Lieut. 21–9–04 ... Lt Col. 22–1–30.

Son of John & Hester Harris of London.

MRIO. M 106, list of Maps submitted from Travancore, 18–1–10, sd. by John Harris, Lieut [132 n.8].

HARRIS, William. Mad. Inf.
b. 1783. d. *c.* 1858.

Lieut. 15–12–1800; Capt. 8–1–13; ret. 24–4–16.

April 1805, MMI., cl. I [320]; Feb.–April 1806, on svy. Madras Environs; 1807, forest map of Karanguli, survd. and drawn, 3 sheets[1], by Wm. Harris, 6th NI. and Thos. Clode [385].

MGO. 17–11–08, to Bombay for work under Malcolm [131 n.10].

1808–9, on Travancore svy.; map of Trichūr and mountains to E.[2] [131].

Wm. Harris of 8th NI. d. before Feb. 1809.

HAWKINS, John. Bo. Engrs.
b. 19–4–1783. d. April, 1831, at sea.

Ens. 21–9–1798 ... Maj. 5–6–29.

Son of Richard & Mary Hawkins of Kingsbridge, Devon.

m., 1st Bombay, 10–6–09, Frances Schutz Drury, who died at sea 21–10–18; 2nd, Susan, who survived him.

FRS.

Bo RC. 28–12–10, appd. to rev. svy. Bombay I.; resd. 14–2–12 on mc. [186, 395]; "Lieutenant Hawkins...received a severe contusion on his head by being thrown from a carriage, by which accident his Brain was considerably injured, and I am of opinion that, from the nature of the injury, he will not for a considerable length of time be able to attend to any duty that requires his being exposed to the rays of the sun, without the greatest danger of producing an inflammation of the Brain".

HEARSEY, Hyder Young.
b. Dec. 1782. d. 5–8–40, Kareli, near Budaon.

Nat. son of Andrew Wilson Hearsey[3]; Ben. Inf. (Hodson); second name originally "Jung"; half-bro. to John Bennett Hearsey (1793–1865), Ben. Cav. (Hodson, II (423)); and to Charlotte, m. Paris Bradshaw [38].

Parentage proved by Ben. Land Rev. records (NAI); petition, 4–9–40, from Harriet Hearsey on death of her bro. Hyder Young, both being children of Andrew Wilson H.; parentage given by *DNB.* therefore incorrect.

ed. in England; m. "a princess of Cambay", who brought him estates.

DIB.; Hodson, I (348) *sn.* Clarkson; IV (568–9); Pearse.

1798, appd. ADC. to Nawāb-Wāzīr of Oudh; 1799, entered Marātha service; ADC. to Perron; 1801, joined George Thomas [57], after whose defeat by Perron, Hearsey offered his services to Lake in 1803, and served against Marāthas the following year.

B Pol C. 20–2–07 (52–5), Govt. refused to raise his allces. to those he received from Marāthas, and "the Corps of Irregular Horse I had the honour to command was called in and was discharged the Service of the British Government on the 12th Dec. 1806".

BMC. 18–1–08 (78), engaged by Colebrooke, with 4 of his *sowars*, as additional escort along the N. borders of Rohilkhand [74, 358–9], and accd. Webb on svy. of Ganges [74–6]. Sent copy of Webb's svy. home to Rennell in attempt to gain personal credit; "When Lieut. Webb was sent to the Gungoutri...he was accompanied, among others, by Mr. Hearsay, a pensioner of the Mahratta Horse, who, when the survey was over, surreptitiously obtained a copy of the Survey, and had the impudence to send it to the Court of Directors, as if he had been the discoverer of this Holy Fountains' Head. On Lieut. W.'s laying the case before Government, they took the affair up very warmly" [77, 340][4]. Hodgson states that Hearsey made this map from Webb's papers whilst Webb lay sick at Bareilly [77 n.8].

B Pol C. 10–1–12 (84), reported to Govt. by AGG. at Fatehgarh for improper conduct; "raising Troops and collecting arms, with a view to invasion of Nepalese territories adjacent to his jagir". Orders were passed for the attachment of his *jāgīr*, and in petition for its release he offered "to earn my bread in foreign service, should at any future period my services in a military capacity be required by the British Government".

ib., 22–5–12 (43), Govt. order his eviction from his *jāgīr*, being "convinced that Capt. Hearsay had been exceeding the privilege of Jagir-holder in collecting Toll on Timber floating down river through his jagir; and also that he had been conspiring to attack and take possession of the Doon, or Vale lying between the Ganges or the Setledge, at present in the occupation of the Government of Nepaul". ib. 22–10–13 (33) Hearsey's *jāgīr* restored, and also his arms and ammunition, "being insignificant in number and value".

ib. 25–6–12, Hearsey applies, 3–5–12, "to withdraw my former application for leave to enter into foreign service, and wish for permission to accompany Mr. Moorcroft in a Tour into the Hills; as he proposes to set off very soon, an answer to this letter I will thank you to forward to my brother Mr. W. Hearsay"[5]. With permit from the AGG., Hearsey and Moorcroft left before the end of May, crossing the Niti Pass, and visiting the Mānasarowar Lake [80–1].

On their journey back, being in disguise, and travelling with caravan of long-haired goats, they were held up as prisoners by the Nepalese for two weeks [80]. Hearsey kept rough svy. of route and produced an interesting map for which he received Govt. donation of Rs. 4,000. Lady Nugent notes a visit, 8–12–13, "from Capt. Hearsey, a very ingenious but uneducated man, who has been making a tour into Chinese Tartary; he showed us a map he had made of that country, and sketches of different scenery"[6].

[1] MRO. Map 42. [2] ib. 401. [3] d. Allahābād, 1798, from riding accident. [4] SG. to Fleming, 23–7–13, DDn. 135 (8).
[5] Wm. H. Hearsey, nat. son of Andrew; d. Shāhjahānpur, 31–10–41; *EIR.* 1842. [6] Nugent, II (70).

The original maps of this expn. appear to be drawn by Hearsey himself, and shew him an able dmn.; amongst the many interesting entries is one telling of their searching the hill-sides with their "Perspective glasses". The maps are "dedicated to William Moorcroft Esq., by his companion and Friend during their arduous and perilous Journey".

Seven of his sketches of mountain views are with High Comnr. in London[1].

1815, Nepāl War, supplied useful sketches and infn.; raised a column of irregular Rohilla levies for service in Kumaun, Feb. 1815; defeated at Champāwat[2], wounded, and taken prisoner by the Gurkhas [90]. "Major Hearsey... advanced in February 1815 from Pilibhit, and penetrated by the Kali, or Western Ghogra, to Chumpawut, without meeting any opposition. During March he blockaded Kootulgarh, a very strong fort, but about the end of the month was defeated and captured. A large force had been sent against him from Nepal; the Rohillas, being raw levies, deserted Major Hearsey after the first fire; he was wounded and made prisoner"[3] [90].

BSC. 7–10–15 (40); Hearsey claims to be "Zamindar & Proprietor of the Doon. On June 22nd 1815 I became the proprietor by purchasing the Title Deeds from the young Rajah of Sirinuggur [then in exile at Bareilly]; ... these had been granted to his ancestors by the Emperor Aurungzebe". The GG in C. considered the claim objectionable, and would pay no attention to it, and on further claims being urged, replied, BSC. 8–12–15 (18), that they saw "no ground for recognizing your claim to the proprietory right to that part of Country, founded on a transaction which avowedly took place after the absolute extinction of the power of the Rajah of Gurhwal by the Gorkah conquest". Hearsey continued to put forward this completely bogus claim at frequent intervals, and on 19–9–20 Govt. told him to establish his claim in the law courts before they would look at it, This he never did[4].

Amonst Hearsey property later established in the Dun was the Hathibarkala estate, now held by Survey of India. Hearsey descendants were still in the Dūn in 1940, with some artistic talent.

HERBERT, James Dowling. Ben. Inf.
b. Aug. 1791. d. 25–9–33, Lucknow.

Ens. 18–3–08 ... Capt. 3–6–24.

Son of Joseph Dowling Herbert.

m., Calcutta, 28–4–23, Mary Manson, possibly sister to James Manson (1791–1862) Ben. Inf.

Hodson, II (434); III (727).

May 1814, survd. route of dett. marching through disputed territories N. of Gorakhpur [198 n.7].

Nepāl War, 1814–5; with unit, 1st 8th NI., Dinapore Div.

Had distinguished svy. career later, in Garhwāl and Simla hills, and at hdqrs., Calcutta [262].

HEYNE, Benjamin, Botanist. Mad. Med.
d. 6–2–19, Vepery, Madras.

Asst. Surg. 30–4–1799; Surg. 21–1–07.

A Dane by birth.

m., Jaganaikerpuram, May 1803, Charlotte Rebecca, dau. of 2 L. C. Topander, probably Dutch; she d. Bangalore, 9–5–17.

MD.; FLS.; Crawford, II (143).

MPC. 22–9–1793, Roxburgh, the botanist[5] [I, 105 n.6], who was in ch. of the pepper & cinnamon plantations at Samalkot[6], ordered to Bengal for ch. of the Sibpur botanical gardens on death of Robert Kyd [I, 347–8], writes that "Dr. Heyne is arrived from Tranquebar, and appears...to answer fully the good character I had received of him". CD to M. 9–5–1797 (13) commends Heyne's researches.

MRIO. M 160, July 1798, visited Hyderābād, where he met Mackenzie; "As soon as my business in the Circars admitted of absence, I set out from Samuelcottah, as well equipped as my circumstances would afford. ... I was a little surprised at the request of my Dubash[7] to accompany me.

"My suite consisted of near 40 persons, 12 Palanqueen boys for myself, and one Mussaljee[8], six boys and Mussaljee for my Dubash's Dooly, four cowry coolies to carry my baggage and provisions, one draughtsman, two Plant collectors, two Peons, one servant, and four Invalid Seapoys, etc.

"In this country no one will think the number of my attendants too great, indeed not even a single man could have been spared without great inconvenience. ... It was requisite to go in a Palanqueen as a shelter...as the rains were about to set in, ... and I had been informed that the Choultries on the road were exceedingly bad. Expedition is another reason for using this mode of travelling, ... the bearers running daily between 25 and 30 miles. ...

"The four Cowry Coolies were thus distinguished; one carried provisions, for nothing is to be expected on the road, sometimes not even rice, without mentioning bread and other necessaries; ... another carried my books and papers for preserving the plants, the third my linnen, and the fourth my Dubash's things. ...

"In this country a man who is Botanically inclined cannot do without people to collect plants, where botanizing in person for any length of time would be hot work indeed. ... A peon or two is always useful to take care of the baggage, a small guard of armed men is likewise necessary as a protection from robbers & Tygers. ... As Plants were daily brought in, I ordered the Painter to draw only the outlines with Indian Ink, and colour only one flower, fruit, and leaf; by doing which I get a great many more plants drawn. ...

"On the night of the first of August I...arrived in the morning at Gave Pardial[9] (mentioned in my last essay on Diamond Mines), where I wished to...make a botanical excursion to the nearest hills; but my Palanqueen Boys objected to it on account of its being a Nizam's village, ... and as they are always absolute, or when they are disappointed make one feel it, I went on with them. ...

"After a few days journey thro' the Nizam's Territories I received a letter from Capt. Mackenzie which was delivered by a Naique and a few men of the Bengal Regiment stationed at Hyderabad who had been sent to escort me. ... I arrived in the morning about 7 o'clock on a high spot of ground from whence I saw Hyderabad to my left in an extensive valley, and the Fort of Golcondah, as well as what is called Old Golconda, both on rising ground on the other side of Hyderabad. The air was sharper than I had felt it any time before in any part of India, so that I was obliged to shut up the doors of the Palanqueen. In the cold season it is so cold here, I understand, that the Gentlemen can hardly keep themselves warm. ...

"The encampment of the Bengal Regiment—to which I arrived about 9 o'clock in the Morning at my friend Capt. Mackenzie's lines, about 3 miles N. from Hyderabad—... appears, on account of the many Bungaloes and the cottages the sepoys have erected, like a small town.

"I was received by him in the most cordial manner, and introduced as soon as it could be done to all his friends and acquaintances. ... Hospitality was excercised in the true Bengal style, unlimited. I had general invitations from the Gentlemen who dined in a mess together, and from Col. Hyndman[10], their C.O. Two days after my arrival I rode

[1] Foster (107). [2] 62 C/3. [3] Prinsep, I (143); cf. *Nepaul Papers* (630). [4] Dewar (460). [5] Wm. Roxburgh (1751–1815). [6] 65 K/4, 10 m. N. of Cocanāda. [7] interpreter. [8] torch-bearer. [9] Purtiala, at junction of Muneru R. with Kistna, 65 D/6; MRIO. 67 (5) is survey of mines dated 1816; *Imp Gaz.* XIII (262). [10] Henry Hyndman, Ben. Inf., d. 1803 (Hodson).

with Capt. M. to the Residency, where I was introduced to Capt. Kirkpatrick[1], ... who received me in the kindest manner. ... This Kirkpatrick has a brother on the Bengal Establishment" [I, 75, 344].

MMC. 4–9–1799, appd. Botanist to the Mysore Survey under Mackenzie, with "salary of 75 pagodas a month in addition to his pay and allowances as an assistant Surgeon", bringing several of the botanical staff from Samalkot with him [91, 93, 113–4, 330]. The following extracts are taken from journal kept by Heyne throughout his time with the svy.[2] He left Madras with Mackenzie 11–3–1800 ;

"27th. In the morning went with Capt. Mackenzie up the Sauntghur Hill. ... I went afterwards up the Maha Devie Gudda, one of the highest Peaks. The Hills are Sienite. ...

"April 1st. We bade adieu to the Carnatic, & ascended the Ghauts thro' the Poodomaig Doorgum Pass, which is the steepest but, I understand, the shortest that leads into the Mysore. ... The Pioneers were still employed in repairing it. ...

"11th. We arrive at Bangalore ; ... encamped on the Glacis of the Fort, from whence we had a fine view. ... From the 12th to 19th staid at Bangalore, when I received a letter from Capt. Mackenzie directing me to come to Seringapatam with all speed, for which place I set out immediately, travelling (both on my way there and back) night and day, I had no opportunity of making any remarks on the Country. ...

"From 22nd April to 7th May, my attention was chiefly taken up with the Sultan's Garden which had been delivered to my charge [113], so that besides some Botanical descriptions of Plants, I had but little time for minerological or other researches. ...

"May 8th. ... We left Bangalore. ...

"11th. Went with Capt. Mackenzie to Sewagunga, one of the highest mounts in this part of the country[3]. ... About 4 o'clock P.M. Capt. Mackenzie ascended, but as I found myself very unwell, I did not go along, but followed slowly. ... Capt. M's mountain Barometer stood, at the top of it, 25·6 inches ; Thermometer 82°, &, as according to Calculation Bangalore is 2897 feet above the level of the Sea[4], ... Shewagunga will be near 1700 ft. higher, and near 4600 ft. above Madras".

Heyne comments on crops, methods of cultivation, climate, vegetable products, soil, minerals, geology, weights & measures, &c.

"Dec. 20th 1800. Early in the morning I was roused by a message of the killadars of the Fort inviting me to see a Tyger that had been caught last night. It was in my way to the Hill Fort close by the Road. The Chitta [248], what it was found to be, had been entrapped by a Goat they had pent up in a place surrounded by a thorny hedge, to which he could only come over a 20 ft. deep hole covered by a thin mat. At the bottom of the pit they had fixed five pikes by which he was sorely wounded already ; he seemed notwithstanding intent upon nothing by revenge ; growling when men came near the pit, & tried to get at them. He was killed by a single musquet Ball that went in at his shoulder plate.

About Oct. 1800 Heyne had left Mackenzie's camp on the N. border of Mysore to return to Bangalore where he spent several months on botanical work at the Gardens. He then moved down to Madras and visited copper mines near Kālahasti and Venkatagiri, a trip which caused Mackenzie much concern, as foreign to his duties with the Mysore Survey [114]. Heyne's journal continues ;

"May 13th 1801. Arrived at Bangalore. Having lost on the last tour 2/3rd of my servants, mostly sick left behind, & all my bullocks, the rest of my cattle were in such a state that 2 days farther journey would have deprived me of them all. One month and 11 days to the 23rd July I staid at Bangalore, where I had been busy, as much as my health & circumstances would allow it, with the Garden, ... being obliged to live in tents during the almost incessant rains. ... Ensign Arthur being also on his way to join Capt. M. [99] I profited by the oppy. & accompd. him.

"August 2nd. We found Capt. M. at Haroor".

Relations between Heyne and Mackenzie became very strained at this time, and Mackenzie refused to countersign his bills for journey to the copper mines ; an accrimonious correspondence ensued, tho' Mackenzie's letters all pleaded for a more accomodating spirit ; "I have been thus willing to meet your wishes (though it be painful to me) by mentioning candidly the light in which your communications appeared to me for some time past, but...any doubts on your side as well as mine would be better removed by a personal conversation, than keeping up a correspondence here which may have already occupied too much of our time and, when you please to come to my tent, I will with pleasure attend to whatever you please to suggest, to...promote that good understanding so necessary for the success of the business we are engaged in"[5].

The resulting conversation appears to have cleared the air, and Heyne remained for the next few months with the svy. detts. looking after the numerous invalids [359–61].

Early in 1802 he obtained leave to Madras on account of ill-health, and by April he was made independent of Mackenzie's svy. [114].

Lord Valentia [392, 410] met him at Bangalore ; "Mr. Heyne, the Surgeon at this station waited upon me. I found that he had expected me, and provided for my accomodation in the palace of Hyder within the town, where there are very handsome gardens in the Asiatic style. He presented me with the seeds of several plants, and drawings of them, possessing great merit, by a native. His knowledge of botany, and his indefatigable exertions, will render the collection he is forming of the plants of the tableland of Mysore valuable and interesting"[6].

Though the Directors—CD to M. 25–10–06 (36–8)—approved his appt. as "Botanist & Naturalist to superintend the Gardens at Bangalore", the appt. was abolished in 1808.

1812, granted furl. to Europe, and, 16–7–14, applied "for leave to return to duty in Madras, from which he has been absent 2 years". Asked to be re-appd. to "the situation of Naturalist on the Madras Establishment"[7]. 1817, visited Arthur at Trivandrum [380].

Early in 1819, granted leave to Europe on me., but died before he could take advantage of it.

In addition to submitting many reports on mines and natural products, pubd., 1814, a volume entiled *Tours through India ; Tracts, Historical & Statistical.*

HILLIARD, George. Ben. Cav.
b. 3–5–1783.

Corn. 17–9–08 ... resd. 13–3–13.
Son of Edward & Elizabeth Hilliard of London.
m., Chunār, 10–11–09, Louisa Ann Anstruther.
ed. RMA. 1788–9 ; Christ Ch. Oxon. ; matric. 1801.
Hodson, II (454).
22–10–10 to 7–1–11, survd. route of dett. under Lt Col. Thos. Brown in Bundelkhand [51].

[1] James Achilles Kirkpatrick (1764–1805) ; Mad. Inf. ; Resdt. Hyderābād, 1796–1805 ; bro. to Wm. (1754–1812), Ben. Inf. ; Resdt. Hyderābād, 1793–6 [I, 344]. [2] MRIO. M. 117. [3] Sivaganga, 4,550 ft., 30 m. NW. of Bangalore. [4] Height of City area undulates between 2,900 and 3,000. [5] DDn. 66, 5–8–01. [6] Valentia, I (356). [7] HMS. 258 (215, 555).

HODGE, James Thomas. Mad. Inf.
b. 25–3–1790. d. 13–9–18, Hyderābād ; MI.

Lieut. 5–7–07.

Son of Peter Pender & Alice Hodge of Cornwall.

m., Mary —, who was admitted to benefits of Lord Clive's Fund, and proceeded to England, MMC. 19–9–19.

Crofton, II (39).

June, 1807, MMI., cl. III [320] ; DDn. 91 (65), 9–11–09, appd. to Lambton's General Svy. ; trgn. and topo. sketch through Sivaganga, 20 m. E. of Madura [242–4] ; rejoined corps, Nov. 1810 ; re-appd. to Lambton's svy., MGO. 16–3–11. Assisted in meast. of Gooty base-line [245], and then recce. for Riddell's trgn. through Nellore [164, 246, 371]. Rejoined unit 1811 [263, 322–3].

MMC. 19–5–13, leave to Europe on mc., "frequent relapses of a Bowel complaint, and obstructions".

CD to M. 3–5–17, permitted to return to India ; posted to Hyderābād Subsy. Force ; Marātha War, 1817–8 ; appd. Asst. in svy. branch of QMG.'s Dept. ; the QMG. writes, Nov. 1818, "At the request of the Resident of Hyderabad, Lieutenant Hodge was directed to place himself at that Officer's disposal in G.O. ... 1st May 1818 ; ... was prevented from so doing in consequence of the Resident being unprepared to receive him, and he consequently continued employed under my orders to the day of his decease, the 12th September last"[1].

Mackenzie had good opinion of him, and writes to the Resdt. at Poona, 7–9–18 ; "In December last I took the liberty of recommending to Brigadier General Thomas Munro[2] an officer who has good pretensions to be employed on survey, Lieutenant Hodge. ... I should think he might be very appropriately employed on such a survey ; he has been formerly employed on the Trigonometrical Survey, whence he had strong testimonials ; it is from these I speak, and from the testimony of different friends, for I have not the pleasure of being acquainted with him personally". Riddell, however, writes, 26–2–18 ; "I do not think Hodge would do for that country. He is a man of abilities and very great application, but has an unfortunate temper, and would not succeed where conciliatory manners were required"[3].

Mackenzie writes, 18–10–18, "One of the excellent young men I recommended to Mr. Elphinstone...is dead of the Cholera Morbus"[4].

HODGSON, John Anthony. Ben. Inf.
b. 2–7–1777. d. 28–3–48, Ambāla ; MI.

Ens. 19–1–1800 ... Maj Gen. 3–11–41.

SG. of India, 1821–3 [285] ; 1826–9.

Eldest son of George Hodgson of Bishop Auckland, co. Durham.

Portrait in SG.'s collection taken from original with family[5].

m., Calcutta, 6–2–22, Matilda Emily Ann, dau. of Thos Norris of Greenwich, and widow of Capt. G. F. Harriott (1780–1818), Ben. Inf. ; she d., Calcutta, 28–11–28, aged 32.

Hodson, II (460) ; *Oriental Club*.

RAS. (*mn*). IX. 1849 (59). "Received the principal part of his school education at the grammar school in the city of Durham, ... and was for some time designed to follow the profession of the law. ... At the expiry of his engagement he availed himself with eagerness of an opportunity of entering the military service of the Honourable East India Company. In the year 1799, at the age of 22, he embarked as a cadet for India. ... Until this time his attention had not been directed either to the Oriental languages or to general science, but he now devoted himself with assiduity to those studies, and especially to practical astronomy. The earliest of his observations (an immersion of Jupiter's first satellite, October 23, 1812, observed at Sitapoor cantonment[6], Oudh) is printed in the memoirs of the Society, Vol. II".

1803–5, served in Ceylon ; 1805–6, Marātha War ; 1809, with his unit, 2nd batt. 10th NI., with Ochterlony's force at Ludhiāna; survd. route "from Ludhiana to Karutch in the Hurriana Country, by Narbah...& Jind, ... to Hansi & Hissar, ... doing duty with the Hon. Mr. Gardner who is settling the District [64–5, 69]"[7].

This opened a correspondence with SG., Garstin, who had met him on a visit to Ludhiāna [401], Hodgson thanking the SG. for "the hint and advice you give respecting the maps, and will avail myself of it as far as in my power. I have not, it is true, the talent of drawing, but will as much as I can add neatness to geographical exactness[8].

1812, SG. reports that Hodgson "has been mentioned to me...as being well qualified to conduct any survey, and to have a useful mechanical turn"[9] [223, 227].

Early in 1813, appd. asst. to White on svy. of the Upper *doāb*, and notes ; "April 1st. Continued Survey in the Doab, from Syeedabad, Lat. 27° 26′ 54″. 2nd. This country abounds with Thieves ; they carried off my tent walls and other things"[10].

Working thro' Anupshahr and Sahāranpur, arrd. Delhi June 27th. Wrote to SG. from Morādābād, July 18th ; "If any exertions of mine shall be fortunate enough to give me your approbation, I will be perfectly content & on the subject of allowances quite indifferent. During this season I will take some latitudes of principal places in this zillas of Moradabad. ... Rohilcund is very poorly surveyed, and a surveyor could do a lot of good work, specially towards the hills [82]"[11].

After a halt for the rains, his journal continues ; "Oct. 1st. Take the field again, commencing at the ferry of Ghur Mukteiser[12], Lat. 28° 49′ 23″.41. ... 17th. I was obliged to make only a short march this Day, that I might apply to the police to search for thieves—who last night robbed me of two valuable guns, Hircarrah Camel's Housing, & other things at the last village—without success"[13].

In Oct., appd. to take over ch. of the svy. when White's health gave way [6, 37, 201–2, 228], and in Jan. 1814 entered the Dūn beyond Sahāranpur, taking care to obtain the consent of the Gurkha governor at Nāhan [82–3, 88, 366]. Climbed Bhadrāj[14] and other prominent hills ; took obsns. to snowy peaks, and sketched as much of the country as he could. Writes to SG. 29–3–14 ; "As I was re-entering our districts, I met with Lady Hood going into the Doon Valley [83], and, as it was her Ladyship's wish, I thought it incumbent upon me to conduct her thro' the valley to Hurdwar. In this trip I was of course obliged to retrace some of my steps, & could only make cursory observations on that part of the route I had not before traversed ; however, I have materials to fill up the maps of the valley [pl. 10]. ...

[1] MMC. 2–12–18. [2] *v.* DDn. 156 (315), 27–12–17. [3] DDn. 151 (148). [4] DDn. 154 (27). [5] SGO. file 111/1923. [6] 63 A/10. [7] DDn. 82 (34), 15–11–09. [8] ib. (75), 4–1–10. [9] DDn. 126 (134), 9–4–12. [10] Journal, MRIO. M. 347. [11] Colebrooke's work of 1807–8 not yet available [84]. [12] 53 L. [13] cf. Burrow's experience in this locality [I, 161]. [14] 7,320 ft., 9 m. W. of Mussoorie.

"Col. Mackenzie was with Lady H. & I had the satisfaction of forming an intimacy with him, & gaining many useful hints from his experience [77–8, 83–4]"[1].

The party visited the hot springs at Sansadhara [380, pl. 10]; "This beautiful & extraordinary dripping spring is caused by a [channell] from the Top of the mountain...depositing Calcareous matter on the brows of a low Knoll of the mountain[2]. This calcar adhered originally, I imagine, to the shrubs & herbage on the brow, and the water freed from it bored as it were Holes thro' the interstices, & found itself a passage thro' these innumerable channells, & falling from the rock which is from the height of 40 to 70 feet like an immense shower bath. It is impossible to describe the beauty of the surrounding Scenery. I refer to Capt. Raper's account of it in 11th Vol. of Asiatic Researches, but the views of it taken by Lady Hood & Lt. Barton [83, 380–1] will give a much better idea than words can[3].

Early in May Hodgson was offered ch. of a svy. of the Himālayan rivers and peaks, which he accepted with enthusiasm [354–5]. He was at this time trying to get permission from the Gurkhas to make an expn. to Gangotri, but had no opportunity of doing so till three years later [77–8, 232]. He writes to the SG. telling of the friendly attitude of the local Gurkha chiefs, and discusses the prospects of war against Nepāl; "It was my wish to have paid my respects to you in Calcutta, but I find all my time will be required for the maps. If you should come up with Lord Moira[4], which I hope you will, I will have great pleasure indeed in waiting on you. As Col. Mackenzie will tell you, he was so good as to direct our attention to a number of points highly interesting, ... and Lady Hood will explain our projects to Lord Moira" [88–9][5].

"I have been, and am, much annoyed by rheumatism & Lumbago, so that I am able to do little in the writing way more than my daily work, the leaning to write giving me much pain"[6].

Mackenzie writes to Crawford about Hodgson's work and plans for svy. of the mountains; "Capt. Hodson [*sic*] appeared to me, from the few opportunities I had of seeing him in the Doon, to possess zeal, enterprise, and science, adequate to his part of such an adventure; and if a party could be formed ... for describing the productions & minerals of that interesting tract, and the manners & customs of the inhabitants, I am convinced the results would be found sufficiently interesting to justify the expence. ...

"Capt. Hodson appears extremely alert & indefatigable in his astronomical Observations, and to possess all that Love for it which is necessary to carry on thro' difficulties. He has now considerable local knowledge of the countries bordering on the Tract to be explored. ... Not having heard from him since May, I rather hope to fall in with him some day in Calcutta, but I could not in justice to my opinion of him neglect the occasion of saying so much to you"[7].

As the rains had now set in, Hodgson was called down to Calcutta to prepare for his new svy., and he writes to the SG. from Cawnpore, 12–7–14; "I am making the best of my way to Calcutta, but a circumstance occurred which may delay my progress a few days. When at Kass Gunga, I received an express from Lady Hood, requesting that I would escort her Ladyship down the River till she should overtake her relation Colonel Mackenzie, as the Hon. Mr. Gardner[8], a friend of Lady H.'s family who had accompanied her thus far, was obliged by his duty to return to Delhy. Consequently I came down by Dak, & leave this tomorrow morning, & hope at Benares or Patna to find Col. Mackenzie, when I will proceed speedly to Calcutta"[9].

Aug. 15th., Hodgson stopped near Dinapore, and met the GG. and the army chiefs who were planning the campaign against the Gurkhas, and were delighted to see his maps of the Dūn [40]. He was doubtless happy to be able to record that "Lady Hood goes down the River the Day after tomorrow".

3–9–14, he writes "on the river near Boglipour" that he had submitted "Maps & Memoirs of the Doon" on 27th, and set out for Calcutta, "but tempestuous weather has compelled me to take shelter frequently in the inlets".

After about a month in Calcutta, including some time on the sick list, he returned up the river to join the Dinapore column as Surveyor, with Barton, Garstin, and Paton as assts. [41–2, 312, 399]. He reached Dinapore on Nov. 27th, and set out for the Nepāl frontier on the 30th. Instead, however, of the triumphant march to Kātmandu that had been expected, the troops were feebly led and spent the next four months pottering about in the *tarai*, and the survrs. had little opportunity [6, 42, 194].

Hodgson writes, March 31st; "I trust that you will make allowances for the embarrasments a Surveyor is placed in with an army; for, however desirous I was to go out, that did not depend on myself, & it was not without difficulty I could get sanction to be absent for a few days"[10]. The war was brought to a successful close by Ochterlony's column in Sirmūr [89], and Hodgson withdrew early in June 1815, a sick and tired man, with little accomplished.

He writes, May 12th, "I am better than I was, but weak & giddy & hazy. I mean to go to Muzafernuggur [Muzaffarpur, Tirhut] as soon as Barton comes in, which I hope will be tomorrow. Again, on 31st, "I propose spending the rains at Muzafarnuggur. ... I should much like to have the pleasure of seeing you in Calcutta, but dread the expence of the trip, & the temptations to throw away money I fall into. ... "At Ooḷanah I was taken seriously ill with the Jungle Fever & Ague, and as the fits came on in the evenings, & with great violence, I cd. not attend to the stars for Latitude. But the weather was also thick & rainy".

At the end of June he settled in for the rains; "Muzzafferpour being the Station of the Court & Collectorship of Tirhoot, is a place of some little consequence. ... The rains have been so heavy since my arrival that I have not been able to take any sort of observation, but am preparing to observe Latitudes & Longitudes by the moon's transits when the weather becomes clear"[11].

At the end of the rains he returned to Sahāranpur, and started preparations for the important svy. of the hill countries won from the Gurkhas, that will be described in another volume [1].

HUTCHINSON, George. Ben. Engrs. bapt. 23–7–1793. d. 28–8–52.

Ens. 23–12–12 ... Lt Col. 4–9–39; ret. 28–8–41.

Son of Dr. Thos. Hutchinson, MD., of Harrogate; bro. of T. F. Hutchinson, Ben. Inf.

m., 1st., Calcutta, 20–3–23, Martha Williams, dau. of James Williams, of Walthamstow, Essex; she d. at sea 1–4–26.

m., 2nd, Calcutta, 20–1–30, Eliza Harington, dau. of Rev. T. T. Thomason, senr. chpn. (192 n.7).

ed. Addiscombe, 1809–10.

Hodson, II (513).

[1] DDn. 136. [2] cf. *Bo Geo Soc.* I n. 99 (12). [3] Journal, MRIO. M 347. [4] GG. & C-in-C. [40 n.10]. [5] DDn. 136, 19–5–14. [6] ib., 28–5–14. [7] ib. 7–7–14. [8] Resdt. at Delhi [65, *sup*]. [9] DDn. 136. [10] DDn. 136. [11] Fdbk. MRIO. M 446.

1813, Asst. Survr. with Robert Smith in S. Mirzāpur [47]; Nepāl War; BGO. 15–11–14, appd. Asst. Fd Engr. with 3rd., or NW. Div. of army under Ochterlony, and employed on svy. thro' Sirmūr till May 1815 [90].

Aug.–Sept. 1818, as Asst. Fd Engr. under John Colvin, with Arnold's field force, survd. route Hānsi to Hissār.[1]

1823, Supdt. of foundry, Fort William.

HYDE, James. Ben. Engrs.
b. 21–10–1783. d. 29–7–21, Aligarh.

Ens. 1–9–03 ... Capt. 1–7–12.

Son of James Chicheley Hyde of E.I.Ho. and Dorothy Fryer, his wife.

Hodson, II (518).

1803–4, took levels and other detailed svys. of Calcutta [17]. 1804, in Bundelkhand with Martindell [48 n.1]. 1810, survd. rocks in bed of Jumna that were a danger to navigation; his sketch is described as being not only "imperfect", but also "perfectly unintelligible"[2]. 1814, Calcutta, studied astronomy under Crawford for 8 months [193].

31–3–13, at Kālpi, Lady Nugent notes in her journal; "Capt. Hyde, of the Engineers, who we met at Kallingar (and who appears a very silly man)...was commanding officer. ... Capt. Hyde...dined with us. My opinion...is confirmed. I had all the histories of all the Hydes from the flood"[3].

BMC. 21–6–16 (98), progs. of gen. ctml. held at Cawnpore, 23–11–15, for trial of Capt. James Hyde, Engrs., sent to CD.

Govt. Gaz. 19–6–17, appd. to supd. Public Works at Almora.

HYDE, John Fleming. Ben. Inf.
b. 28–9–1785. d. 12–5–46, Calcutta.

Ens. 3–7–07 ... Capt. 1–5–24; struck off, 11–3–26.

His mother became Gertrude Dowling on 2nd marriage.

m., 15–2–13, Eliza Pearson, who d., Calcutta, 17–11–17, aged 23. MI., S. Park St. cem.

Hodson, II (519); III (802).

BGO. 11–3–13, appd. to svy. suburbs of Calcutta [18]; DDn. 141 (6 A), 23–4–14, appd. Asst. to SG. [296–7,312]. BGO. 3–12–14, permitted to make a voyage to New S. Wales for the recovery of his health; granted extension and resumed ch. of SGO. 7–2–16. Resd. post 1821; furl. to Europe, returning to Calcutta to become Sec. to Lottery Committee.

JACKSON, James Nesbitt. Ben. Inf.
b. 16–8–1788, Calcutta. d. 8–6–32, Calcutta.

Ens. 27–4–05 ... Maj. 2–3–30.

Son of Wm. Jackson, Registrar of Supreme Court Calcutta, and his wife Margaret.

m., 1st., Cawnpore, 26–2–11, Augusta Katharine, dau. of Col. Wade, 25th Lt. Dragoons; she d., Calcutta, 5–4–31.

m., 2nd, Calcutta, 10–4–32, Mary, sister of Malcolm Nicholson.

Hodson, II (538); III (729).

BMC. 8–1–14, appd. from duty with Rāmgarh Batt. to svy. boundaries between Burdwān, Hooghly, & Midnapore; recalled, 6–1–15, for Nepāl War [19, 312].

From 1–1–17 with QMG.'s dept.; occasionally on svy.

JERVIS, George Ritso. Bo. Engrs.
b. 6–10–1794, Madras. d. 14–10–51, Boulogne.

Ens. 8–6–11 ... Lt Col. 16–8–43.

Son of John Jervis, MCS., and Elizabeth, dau. of Capt. G. F. Ritso, RE.; bro. to Thomas Best Jervis, Bo. Engrs., who founded the Geographical Section at WO., 1855.

m., 28–7–21, Harriett, dau. of J. G. Brett, of Old Brompton.

1814, survd. routes through Gujarāt[4]. 1816, April to Aug., asst. to Sutherland on svy. of E. borders of Gujarāt, N. of Narbada R.[5] [pl. 15].

Later became CE. Bombay.

JOHNSON, John [I, 341] Bo. Engrs.
d. 11–2–46.

Ens. 31–5–1785 ... Bt Lt Col. 4–6–14; ret. 15–8–19.

m., Diderica Memeling, probably Dutch.

CB. 4–6–15; *EIMC.* I (220).

Surveys in Deccan & Malabar from 1790 [I, 128, 130–1].

1800, in ch. engr. works at Goa; 27–10–00, ordered to "Hullihall", near Dhārwār[6], interrupting his svy. of Sonda arranged by Mackenzie [96–7, 158, 318].

Bo GO. 3–3–02, appd. to comd. Pioneers; writes to Wellesley, 29–6–02, from "Hullihall in Soonda", asking for 50 days leave to Cannanore, having been appd. some time ago to comd. the Pioneers, and having frequently asked leave to join them in Malabar. Wellesley refused until the work at Hullihall was finished; "because, however important the works may be which are carrying on by the Pioneers in Malabar, I conceive that those works could not be superintended by an officer more zealous or more capable...than Lt. Williams [323], who has had charge of the Pioneers for nearly 2 years since Capt. Moncrieff quitted Malabar for his Health [I, 357]".

1803–5, Marātha War; in ch. of the Engrs. of Wellesley's army, and distinguished himself at Ahmadnagar, Gāwīlgarh, and Assaye. Blakiston writes; "The conduct of Capt. Johnstone of the Engineers was the theme of admiration from the General downwards. Indeed I think he was, without exception, the best officer I ever served with. To great natural and acquired talents he joined a zeal and an ardour in his professional duties which I never saw equalled. ... Having no one to assist him in the duties of an engineer he was compelled to live constantly in the trenches during the siege [of Gāwīlghar], "but a strong constitution enabled him to get over it without injury"[7].

Wellesley himself writes; "Throughout this campaign that officer has performed the most important service in the department of the Guides entrusted to his charge; and I have no doubt but that his surveys will be a valuable public acquisition"[8].

His surveys were indeed of the greatest value, and Mackenzie writes to him from Madras; "Having been desirous of improving our maps of the northern parts of the Dekan, I shall be much obliged to you for anything you can communicate of this kind; the marches, in particular, from Bourhanpour to Aurungabad and to Ellichpore, ... with any latitudes you may have observed; for if any surveys with the army have been sent down they are kept secret, and I have never seen any yet, and scarcely will, I suppose, if I do not get them from yourselves direct. I wish you could... communicate copies of them, even if they were only traces in pencil"[9].

At the end of the campaign Johnson completed "*A Map of the Seat of the war in the Dekhun in 1803 and 1804*, which remained the standard authority until superseded by svys. of the war of 1816–8 and after [165–7].

Nov. 1805, deputed to Kanara to take ch. of forests [167–8], and collect "timber for the construction of Ships". He was given a definite contract, and in asking for Madras Govt.'s assistance, Bombay forwarded a note from Marine Bd., in which they "beg leave to recommend a compliance with the request of Capt. Johnson, Government having a pledge in the established character of that officer far better

[1] MRIO. 81 (12, 13). [2] BMC. 24–11–10 (28); 25–1–11 (29); 3–11–11 (154). [3] Nugent (120). [4] DDn. 278 (27). [5] Bo SC., 30–7–17. [6] *Supply Desp.* III. [7] Blakiston, I (106, 232). [8] Gurwood (521), 15–12–03; cf. Colebrooke, I (65, 91); Cadell (140); Welsh (172, 216); Vibart (387, 394). [9] DDn. 66, 7–1–04.

than the pecuniary security of any speculative adventurer, that the trust reposed in him will not be perverted to any purpose foreign to the public good"[1]. He continued in ch. of this duty 2½ years, "on crutches, having been severely cut while felling Teak, and in consequence in 1808 obliged to proceed to Europe for recovery"[2]. Left interesting note on fevers of Malabar [362–3].

Times, 24–12–1948, gives instance of teak-built ship of Bombay. The training ship *Foudroyant*, refitted in England, 1948, originally "built at Bombay, and launched in 1817 as the 46-gun frigate Trincomalee, ... is the only one left of the teak-built ships constructed at Bombay for the Royal Navy by members of a Parsee family whose hereditary craft was shipbuilding, and who supplied the Navy with some notable ships".

June 1813, returned to Bombay to be SE.; 1815, appd. DQMG. with force operating in Cutch and on Gujarāt frontier against *pindāris*.

JOURDAN, Henry George. Mad. Inf.
b. 1–6–1784. d. 10–11–60.

Lieut. 17–7–05 ... Lt Col. 6–7–33; ret. 15–2–36; Hon. Col. 28–11–54.

Son of John Jourdan, weaver, of London, and Susannah his wife.

m., Java, 1815, Mary Johnson, dau. of Lt Col. H. F. Holcombe, CB.; RA.

April 1806, MMI., cl. II [320]; MMC. 11–5–10, appd. to svy. branch, QMG.'s Dept. [321–2]; 1809–10, on svy. Berār frontier, and near Hyderābād [50 n.6, 134, 166]; Feb. 1811, rejoined corps.

MGO. 9–4–11, to Java expn., attd. to HM. 59th Regt. [320]; JPC. 28–1–13, appd. a local Resdt. under Comnr. at Suracarta [320];

DDn. 149, 2–11–18, recdd. by SG. for ch. Guntūr svy. being on the spot; not practicable, and, MMC. 17–7–19, granted 3 years furl. to England.

DDn. 204 (80), 29–7–24, recdd. by Blacker to be DSG. Madras, but Montgomerie appd.

KATER, Henry. HM. 12th Foot (now 2nd Batt. Suffolk Regt.).
b. 16–4–1777, Bristol. d. 26–4–35, London.

Ens. 25–4–1799 ... Capt. 62nd Foot (now 1st Batt. Wilts. Regt.) c. 1807; to ½-pay from 1814.

Son of Henry Kater, of German descent.

FRS., 1815; *DNB.*; portrait, N P Gall. [pl. 21].

After 2 years in a lawyer's office, resumed math. studies on his father's death, 1794; purchased comn. in 12th Foot, joining in Madras.

Introduced by Col. Haselwood[3], applied, 27–2–02, for employment under Lambton who obtained his appt. from 13–8–03 as "a young man of promising talents who can render himself of immediate use" [238, 322]. This does not wholly bear out Warren's story that Kater, "having been appointed without his being consulted, was regarded with no favourable feelings. But the gentleman having joined the survey, Lambton was not long in remarking his talent. He acknowledged to a friend [presumably Warren] that he had been completely mistaken in his prepossessions; that he was a genius of no common stamp, and that he would certainly shine one day conspicuous amongst the scientific men of his time. A prophesy that was fulfilled to the letter"[4] [312–3].

Kater was first employed on svy. of the Pelar R. from the sea to the Mysore frontier, and then on recce. for the main trgn. across the W. Ghāts down to the coast [4, 239, 241, 259–60, 322, 346, 359]. Lord Valentia records a meeting;

"Feb. 20th [1804]...I have met with Mr. Cator, a gentleman who was assisting Major Lambton with his survey; and it was fortunate that I did so, for I found shortly after that a cooly had run away in the night with all my eatables and breakfast apparatus. He kindly assisted me in repairing the loss, and in the evening we moved on together a few miles to a spot where he pitched his tent, and I slept in the open air in my palanquin.

"21st. After breakfast we rode forward, on Mr. Cator's horses, through a continuous jungle to Kishnagherri (on the Vellore–Seringapatam Road), leaving our palanquins to follow in the evening"[5] [333].

1805, Kater was deputed to run a series of 2nd-ary triangles N. from the Malabar coast, and thence E. across the peninsula [240, 370–1]. He carried on till his health broke down in Jan. 1806, when Lambton advised him to give up. [362]; "As your constitution does not appear to be competent to the laborious duties of your situation, I shall strongly recommend you, both in justice to yourself and the public service, not to remain any longer in it; and I assure you at the same time that I have a just sense of the merits of your late service, and shall give a faithful representation of them in my next Publick Report"[6]. Kater's resn. was accepted 6–2–06, and he was granted furl. from 11–2–07, a year later.

After return home, he was promoted Capt. in the 62nd Foot without purchase, and was for some years Bde. Maj. at Ipswich, hdqrs. of the E. Dist.

Invented prismatic compass *c.* 1812 [232].

Made pendulum obsns. at the chief stations of the Trig. Svy. of Gt. Britain, and designed new pendulums. 1821–3, made obsns. for long., Paris and Greenwich.

5–3–23, writes to Lambton, not knowing of his death, "I am endeavouring, and with success, to make small instruments supersede large ones by using telescopes and microscopes numerous. I have a superb instrument which repeats in altitude and azimuth, made, much to his credit, by Dolland on my own plan. The telescope is only 18 inches long, has 2 inches aperture, and bears a power of 125. I saw a staff of 3 inches diameter on Dover Castle with it from Cap Grinez with perfect distinctness. The lower circle is only one foot in diameter, and has three microscopes reading to single seconds. An angle taken with this without repetition...seldom differs more than a second from the determination of the Great Theodolite"[7].

A zenith micrometer, with telescope of 6 feet focal length, as recdd. by Kater, was sent out by Dollond, and as it arrived after Lambton's death, was bought by Govt. for the SG.[8]

DDn. 204 (133), 31–12–24, SG. reports purchase of standard scales and other measures sent out for Lambton, "having been made under the superintendence of Capt. Kater, one of the most active Commissioners for the enquiry into the state of the Weights and Measures appointed by H.M.'s Government at home".

As Vice-Presdt. RS. read, 14–5–30, a *Paper on Saturn's Rings*, and the same year was granted the Society's

[1] HMS. 493 (143 *et seq* 31–10–05 to 6–11–05); MPC. 26–11–05. [2] *EIMC.* I (220). [3] Mackenzie to Mountford, 12–10–20, DDn. 149 (152); Joseph Haselwood (d. 1844) Mad. Inf.; Ens. 1791; Lt Col. 1809; inv. 1811. [4] Warren (82). [5] Valentia, I (381). [6] DDn. 63 (135), 11–1–06. [7] DDn. 220 (313). [8] DDn. 197 (114), 24–3–23.



Henry KATER (1777–1835)

As Ensign of H.M. 12th Regt. of Foot, appointed assistant on Lambton's General Survey, 1803 [238]. Resigned 1806 on account of ill-health, and subsequently had a distinguished carrer as scientist and Fellow of Royal Society [262]. Amongst his interests were pendulums, standard measures, and the design of instruments.

From a portrait by George Richmond in possession of the Trustees of the National Portrait Gallery, and reproduced with their permission.



Jean-Baptiste François de WARREN (1769–1830)

As John Warren, arrived India 1793, and commissioned 1798, as Ensign, in H.M. 33rd Regt. of Foot, Assistant Surveyor on Mysore Survey 1799 to 1802; assistant on Lambton's General Survey 1802–5; acting Company's Astronomer, Madras Observatory, 1805–12 [pp. 312–3, 449–53].

1816, succeeded to family title as Comte de Warren; readmitted to French Army as Lt. Colonel, and created Chevalier of the order of St. Louis; 1824, Chevalier of the Legion of Honour.

Retired to Pondicherry where he died.

The portrait in the possession of his family in France, of which the above is a copy, was obviously taken before July 1791 when he first left France.

gold medal for the invention of a floating vertical collimator, described in *Phil Trans.*, 1828[1].

Other papers include one on length of Pendulum, *Phil Trans.* 1818 (33–102), and another on length of French metre in English units, ib. (103–9).

KINSEY, James Strange. Mad. Inf.
b. 3–8–1788, Trichinopoly. d. 14–9–24, Negapatam.

Ens. 21–10–09; Lieut. 22–1–15; inv. 1–8–18.

Son of Gen. Wm. Kinsey, Mad. Inf. & Isabella his wife; not a bro. of Chas. Kinsey, MMI. cl. II [320].

m., 7–1–20, Miss C. H. E. Welles, dau. of Capt. Welles, of Dutch service.

March 1810, MMI., cl. V [321]; 22–5–10, appd. to arrange and register the svys. of the Instn.; MMC. 29–1–11; "Afflicted with a malady of the Eyes, which renders him unfit for Regimental duty, but his qualifications for his present employment have been assiduously and advantageously excercised in the office" [129, 275–6, 301]; ordered to join unit.

MMC. 18–10–19, with Mad. N. Veteran Batt.; granted 3 years furl. to Europe.

KNOX, Robert. Mar. Survr.
b. *c.* 1784. d. 6–6–10, Calcutta, MI. S. Park St. cem.[2]

Arrd. India 1798.

A ship's officer, engaged by SG. to svy. the coast and islands from the Ganges along the face of the Sundarbans between Dec. 1802 and June 1803, comdg. the gunboat *Scourge* [10][3]. Then employed to svy. creeks along right bank of Hooghly till Nov. 1803, when ordered to sail the *Tiger* to Balasore and report to Lt Col. Harcourt, comdg. in Orissa, for svy. of the Mahānadi R. and coast to Palmyras Pt. [11–12, 418].

Interrupted by ill-health, and "a rheumatic affection of both knees", Knox continued svy. of Orissa coast till end of 1805, when the svys. were closed as a measure of economy [18, 23, 191].

He writes, 1–12–05; "I embarked for India on the Hon. Company's Service on His Majesty's Ship La Vergenie, with the late Governor General, the Noble Marquis Wellesley[4], and remained in the same Ship...until I was employed...as marine Surveyor; since which time I have commanded the Gun Vessel Scourge, Surveying in the Sunderbunds. Afterwards I was sent in charge of the Agent Vessel Charlotte with Colonel Harcourt on the Expedition against the Mahrattas, and since then I have been in charge of the Gun Vessel Tiger, surveying the Conquered Country[5]".

Disch. early in 1806 [12].

LAMBTON, William. HM. 33rd Foot.
b. 1753/6. d. 20–1–23 Hinganghāt[6], near Wardha, in CP.; MI.

Ens. 6–5–1782; Lieut. 1–3–1794; Capt. 25–6–1803; Maj. 19–5–08; Bt. Lt Col. 4–6–14; STS. 1–1–18.

Parents not known[7], tho' Warren says that their condition was humble, and Lambton told a friend "that much of his early savings had gone to support" one of them.

He had a sister Dorothy, who m. Thomas Lye, of Yorkshire, and d., Feb. 1827, leaving her husband surviving. She had two sons, Thomas who d. Dec. 1825, and William Lambton, who, with his father, was living in 1829[8].

d. unm., leaving two nat. children, William & Eliza.

FRS. 9–1–17; Corr. Member, Institute of France.

DNB.; *DIB.*; *RM Cal.* V; *EIMC.* III (100); Warren; Ingledew; *A & N Mag.* XI (165); Markham (60); Geo. Everest (4–5, 22–32); *Statesman*, 13–1–1923.

The articles in *DNB.* and *A & N. Mag.* were both written by H. Manners Chichester, and based largely on Ingledew, who appears to have drawn from local research. Warren's sketch was in the form of a series of letters pubd. anon. in *Mad. Govt. Gaz.*, and reprinted in *Ben. Harkaru*, and read at ASB. 3–9–23; *v. As J.* XVII. April 1824 (377).

"These letters were written by one who lived on terms of intimacy with the subject of them for twenty years. The style of them, as well as many of the expressions, seem those of a foreigner not quite familiar with the idiom of the English language. (If our conjecture as to the author of these letters be correct, he appears to have paid the debt of nature himself very soon after he had performed this last duty to his friend's memory). Instead, therefore, of reprinting them, we have recast the whole, and have introduced such remarks as seeem called for by the occasion". Warren is the only possible person who could have written the original letters, and their editor must have been J. D. Herbert, who founded and ed. *Gleanings in Science*, which appeared in Calcutta 1830–3, and contains the bio. sketch.

Portrait in oils by Wm. Havell, Hyderābād 1822. presented to R As Soc., London, in 1828, by Sir Wm. Rumbold[9]; contemporary miniature with S of I.

No contemporary record of birth has been found, and the date 1756 is that suggested by Ingledew. Warren gives 1753 "on the credit of the following anecdote. ... 'Being on duty with him in the Coorg country in the year 1803 [239–40]. Capt. Lambton told me that, a few days before at a dinner party, ... the Raja of Coorg...came about desert [*sic*] time with his suite, as he was wont to do, to converse with the company; when from an odd whim he proposed that everybody present, himself not excepted, should declare their age; and to set the example his Highness mentioned his own forthwith. The ladies who were present met the challenge handsomely, as did everybody else in the company, excepting the Philosopher, who rejected it as an instance of ridiculous curiosity. 'What would you have said (he observed to me) if I had acknowledged *Fifty*'?"[10]

In Everest's personal copy of Jervis's lecture on Indian Surveys[11], Jervis's figure for Lambton's age at his death is corrected by Everest in ink from 73 to 67, which would give date of birth 1756. It is possible that Everest took this date from Ingledew, whose book was pub. 1858. Walker (GTS. XII, sect. 44) accepted Warren's date 1753, which seems to be the earliest possible. A notice of his death in the *Cal. Govt. Gaz.* puts his age as 75, which would throw his date of birth back to 1748, and make him 51 at the siege of Seringapatam, which is most unlikely.

Ingledew states that Lambton was born at Crosby Grange, a farmstead near the Great North Road, "a quiet and beautiful spot", a mile from Thornton-le-Moor, and 4 m. W. of Leake and S. of Northallerton, in the N. Riding of Yorkshire.

He was ed. first at Borrowby, about 2 m. from Crosby Grange, and then admitted as a free scholar to the Grammar School at Northallerton thro' the patronage of 3 gentlemen of the neighbourhood[12]. A condition of such admission was that the free scholar should be the child "of poor parents of the parish". He is said to have finished his studies under

[1] *Memoirs RAS.* IV, 1831 (33–7). [2] *Oriental Ob.* III (131); *Ben. Ob.* 1851 (95). [3] Chart, MRIO. 101 (30–1). [4] Arrd. Calcutta as GG. 17–5–1798. [5] BPC. 2–1–06 (26). [6] 48 m. S. of Nāgpur. [7] Elizabeth Lampton [*sic*], of Boroughby (now Borrowby), bur., 3–10–1762, at Leake, may have been his mother. [8] Orders in Chancery; 1829–B–2401, 11–3–30; B–1455, 1829–30. [9] 3rd Bart. (1788–1833); partner in Wm. Palmer & Co., Hyderābād. [10] Warren (74). [11] Thos. Jervis (15); Everest's copy now with GBO Lib., Q. 66. [12] The Rev. Heber, of Thornton-le-Beans, 2 m. from Crosby; Leonard Smelt, of Langham Lodge; Rev. John Wind, of Thirkleby near Thirsk.

Charles Hutton[1], the celebrated mathematician, who from 1760 to 1773 kept a school at Newcastle, where he gave lectures in higher maths. that were largely attended by boys from the Newcastle Grammar School, tho' there is no evidence that Hutton was ever a regular master at the Grammar School, or that Lambton was ever a pupil there. Hutton also worked as a surveyor, and during 1769–70 was employed in making a map of Newcastle and its suburbs.

Warren suggests that Lambton "owed his initiation into mathematical studies" to "the famous mathematician Emerson"[2], who lived near Darlington, about 15 m. N. of Northallerton. "This is rendermore probable by his being fond of repeating anecdotes of Mr. Emerson, having relation to his singularities of disposition and person" [250].

There is no further record of Lambton's early life[3] till 28–3–1781, when he was appd. Ens. in Lord Fauconberg's Foot, one of the so-called 'provincial' or home-serving regts., that was then doing duty at Hampton Court and Windsor. The following year he tr. as Ens., 6–5–82, to 33rd Foot, which was amongst the troops that surrendered to the Americans at York Town, 19–10–81. Lambton joined the interned companies at New York, and on conclusion of peace in 1783, whilst the regt. moved to Halifax, Nova Scotia, he was sent, 19–4–1783, as Asst. Engr., with carpenters, to Port Roseway, also in Nova Scotia, to assist in settling the loyalists. Port Roseway is the old name of Shelburne[4], which lies near C. Roseway ; 31–3–1785, Lambton was still Asst. Engr. Shelburne.

During mid-winter at end of 1784, he accd. Benjamin Marston on a 70 m. svy. from Fredericton to St. Andrews, and on to St. John, by the Oromocto R[5]. By this journey they determined the separate course of the Magaguadavic R. which the Americans claimed as identical with St. Croix R., laid down by Treaty of Paris, 3–9–1783, as W. boundary of New Brunswick. The survd. route is shown on Sproule's map of 1786[6], and Lambton's original map is still preserved at Fredericton. Bald Mountain, New Brunswick, was shewn as "Lambton's Mountain" in some early maps.

1785, Lambton was Asst. Engr. at Fort Howe, St. John[7], in New Brunswick, and under Royal Warrant, 4–8–1785, was appd. "Barrack Master of the Barracks for Our Forces in Our Province of New Brunswick in America"[8].

Warren writes of this period ; "He was employed in 1784... as a surveyor to measure the grants of lands passed by the Government to the new settlers. During the service he suffered, according to his own account, a severe injury in his eye. Employing a common theodolite to observe a solar eclipse, he omitted to attach any coloured glasses to the eyepiece, the consequence of which was a cauterization of the retina of the left eye. The accident, though it did not deprive him of the sight of the eye...occasioned the view by it to be distorted.

"Soon after this accident, Mr. Lambton's friends in Europe (and particularly the Late Sir Brook Watson, Commissary General of the Army in N. America)[9] procured him the appointment of Barrack-Master of the Province of New Brunswick with a salary of £ 400 per annum. During his sequestration of 13 years in that wild country...he applied himself to the study of mathematics, and (to use his own words) 'laid the foundation of that knowledge which was one day to bring him to the notice of the world'! He retained his ensigncy in the 33rd Regt., but obtained no promotion, and was superseded for several years".

According to *RM Cal.* he also received warrant as Barrackmaster from the Board of Ordnance, "which made it therefore double pay". The 33rd was ordered home in 1785, but, continues *RM Cal.* ; "although the bias of Ensign Lambton's mind was decidedly for a military life, yet peculiar family misfortunes rendered it necessary for him to attend to certain private duties which could not have been fulfilled had he joined the regiment and relinquished a respectable situation and a moderate income, and he therefore remained in America, and gave up all hopes of military promotion ; he was however permitted to retain his commission as Ensign, but remained eleven years at the head of that rank"[10].

His name appears in the *New Brunswick Almanac* for 1790 as Bkmr. at Fredericton.

In 1793 Arthur Wellesley was appd. to comd. the 33rd and, says *RM Cal.*, "seeing an officer so many years stationary...without knowing anything of him, gave in his name for promotion, and to his astonishment he (Lambton) found himself a Lieutenant".

"In 1795" writes Warren "the Duke of York[11], having resolved on reforming the British Army, ... determined to clear from it all its useless members ; and ordered that all officers who held civil appointments...should declare by which service they meant to abide. Lambton consulted his old patron, Sir Brooke Watson, who, impressed with a persuasion (very common in those times in England) that to go to India, and to acquire a fortune there, were the same thing, advised him to prefer his Lieutenancy".

In Aug. 1796, Lambton received orders to join his regt. in the E. Indies[12]. The 33rd reached the Cape July 1796, and sailed in Nov., reaching Calcutta, 17–2–1797. In Aug. it sailed to Malaya with the expn. intended for the capture of Manila, but the expn. being recalled it arrd. back at Calcutta, Oct. 1797 [I, 350]. It is not known exactly when Lambton joined, but Warren's account, derived from Lambton himself, says he rejoined "in Calcutta after 13 years absence"[13]

Whilst in Calcutta he contributed two papers to *Asiatic Researches ; Observations on the Theory of Walls*, and *Machines in Motion ;* both show mastery of advanced maths., and mechanics.[14]

According to Warren "he found a subaltern's prospects, without means of purchasing promotion and without interests, anything but brilliant, and he feared 'that he had heedlessly cast off his sheet anchor' as he expressed it". However Sir Brook Watson's introduction to Sir Alured Clarke[15], on which he had placed little reliance, proved of value, and brought him the appt. of Bde. Major to King's Troops in the Presdcy. of Fort St. George[16].

[1] Dr. Hutton (·1737–1823) ; b. Newcastle. LLD. ; FRS. ; Professor of Math., RMA., 1773–1812 ; Auth. of *Math. Tables*, 1781 ; *A Course of Mathematics*, 1811 ; *Logarithms*, 1785. [2] Wm. Emerson (1701–82) ; b. & d. at Harworth, near Darlington. *Ency. Brit.* ; *DNB.* [3] His employment as Engr. in America points to previous experience as such. [4] 43° 40′ N. ; 65° 20′ W. ; *Winslow Papers* (259–68) ; Canada Arch. SR. 14299, 1–3–1935. [5] Marston's interesting diary of this trip is still preserved in his family. [6] George Sproule, SG. New Brunswick, 1786 ; Map pubd. RS. Canada, Progs. 2nd Se. VII (412). [7] 45° 10′ N. ; 66° 11′ W. [8] WO. 25 ; 38 (309). [9] (1735–1807) Commy. Gen. N. America 1782–3 ; *DNB.*, Lord Mayor, London, 1795–7 ; cr. Bart. 1803. [10] *RM Cal.* V (36–9). [11] Frederick Augustus (1763–1827), 2nd son of King George III ; Fd. Marshall, 1795 ; C-in-C. from 1798. [12] Order dated Halifax, Nova Scotia, 8–8–1796 ; Canada Arch. SR. 142–99, 1–3–1935. [13] *A & N Mag.* says that Muster Rolls shew him as with Regt. at Cape ; but *Cal Alm.*, 1796 (61), does not shew him amongst officers arrvd. from Cape ; he possibly joined regt. on its return from Malaya. [14] *As R.* VI, 1799 (93–101 ; 137–61). [15] C-in-C. Bengal & India, 1797–1800 ; *DNB.* [16] GO. by C-in-C., 8–8–1798.

His move to Madras coincided with that of the regt. on its way to the 4th Mysore War [I, 118], and Lambton sailed in the same ship as Wellesley and regtl. hdqrs. On the way down the Hooghly the *Fitzwilliam* grounded on the Sāgar Sand, 19–8–98, and Wellesley writes; "The ship struck this morning at about five, upon what is called Saugor Reef, and remained fast until about one, when she was got off, I might almost say, by the bodily strength of the soldiers of the 33rd Regiment. ... If the weather had not been more moderate than it is usually, we must all have been lost. ... The ship leaks less than I at first imagined, and we have fine weather, and every prospect of a favorable passage".

He writes in another letter; "In a few days I shall send you an official complaint against Capt. —'s Office for having sent bad water on board the ships. ... Instead of sending up to Hooghly for it, it was taken into the casks at Calcutta and was brackish. It is unpardonable, as I warned him of it. ... The neglect upon this occasion has been the death by dysentry of 15 as fine men as any we had, and of the sickness of nearly the whole regiment, myself not excepted"[1].

Warren's account continues; "Col. Wellesley seemed to take little notice of Brigade Major Lambton during their voyage. ... However, on arrival at Madras, Lambton, being disappointed in the expectation had formed of living in the C-in-C.'s family[2], was invited by Colonel Wellesley to reside with him. ... Warren...who was also addicted to mathematical studies, was asked by Col. Wellesley what he thought of Lambton's attainments, and replied that they were very respectable; Col. Wellesley rejoined that though no judge himself on such subjects, he could easily believe him to be a proficient by what he had observed of his acquirements in other pursuits. Wellesley's manner to Lambton continued so reserved that Lambton had fully made up his mind to leave his hospitable roof. Warren advised him not to be too hasty, and told him he was sure the Colonel had a high opinion of him, and Lambton replied; 'I would believe it if he would do me the honor to speak to me'. He was persuaded to continue as Wellesley's guest all the time the regiment stayed at Madras".

Tho' Lambton did not accy. the regt. to Mysore the following letter written by Wellesley to his bro. Henry[3] 14–10–1798, is quoted to shew how soldiers of that period ran their messing; "As I think it probable that we shall take the field, and as in that case I shall be obliged to keep a table, I must get some plate, which is the only certain method of having anything to eat off, and in the end it comes cheapest. If Mornington has bought that plate of Hunt's, and does not want it, I shall be glad to have the soup-tureen and dishes at the price he paid for them. ... I shall not want plates, knives, nor spoons, as everybody in an Indian camp brings those articles for himself; the host finds eatables and dishes only"[4].

For the Mysore campaign Lambton was attd. to the staff of the 1st Bde. under General Baird[5], that was composed of King's troops, and the following is Warren's account of an incident at Sultanpet that has been often told[6]. "On the 4th of April 1799, General Baird received orders to proceed during the night to scour a Tope where it was supposed that Tippoo had placed an advanced post. Capt. Lambton accompanied him as his Staff, and, after having repeatedly traversed the tope without finding anyone in it, the General resolved to return to camp, and proceeded accordingly, as he thought, towards Headquarters. However, as the night was clear, and the constellation of the Great Bear was near the meridian, Capt. Lambton noticed that instead of proceeding southerly, as was necessary for reaching the camp, the division was advancing towards the north; that is to say, on Tippoo's whole army; and immediately warned General Baird of the mistake. But the General (who troubled himself little about astronomy) replied that he knew very well how he was going without consulting the stars. Presently the detachment fell in with one of the enemy's outposts, which was soon dispersed; but this at last led General Baird to apprehend that Capt. Lambton's observations might be correct enough; he ordered a light to be struck, and on consulting a pocket compass, it was found (as Col. Lambton used humorously to say) that the stars were right!"

Another account says that Baird used a firefly for reading the compass. This was the same "tope" in which Mackenzie and Wellesley had their adventure the following night [I, 351].

Lambton's brilliant leadership at the final assault of Seringapatam, 4–5–1799, is described by Allan and Mackenzie. Allan writes; "The left attack met with serious opposition; ... many officers were killed and wounded, but Capt. Lambton (Brigade Major to General Baird), putting himself at the head of the troops, forced the enemy to give way. This column was severely galled by musketry...till a handful of men...drove the enemy from it [the inner rampart]. Capt. Lambton who had advanced along the outer rampart, halted the same time opposite this sallyport through which the enemy were retreating...in the greatest consternation. The slaughter under this gateway from the firing of both our parties was prodigious. Capt. Lambton proceeded along the rampart, stationing small parties in the works, and joined General Baird on the E. face. ... In one hour the ramparts & every part of the fortifications were occupied by our troops [I, 9, 308]"[7].

Mackenzie writes of the same incident; "The sight of such formidable numbers naturally gave a check to the leading men, and, having no officer to lead or direct them, they came to a stand, calling out for more troops to come forward and support them; Brigade Major Lambton who, previous to crossing the River, had been sent by General Baird to the Left attack, and Capt. G., happening to be both present at that juncture, and finding a ready obedience to their orders, they gave every assistance in their power by posting the men in situations where they could fire to the most advantage"[8].

After the fall of Seringapatam, columns were sent to the W. frontiers of Mysore to reduce hill forts, and various hostile gangs, the chief of which was led by Dhoondia. Lambton acc'd. the hdqrs. of the Grand Army, and has left a journal of the marches from 10–7 to 22–11–1799. Gen. Harris with the main body marched thro' Chitaldrug to the Tungabhadra, whilst advanced columns captured Shimoga and other frontier towns, but Dhoondia eluded them and escaped into Sonda [96 n.4] and Marātha country[9].

Harris handed over to Wellesley at Honnali, 26–8–1799, and for the next 3 months Lambton continued on the hdqr. staff, presumably messing with Wellesley. They advanced thro' Shikarpur[10] and reached Sonda on 11th Oct., without regaining touch with Dhoondia. Returning thro' Haider Naggar, Shimoga, and Belur, Lambton records his last entry at Cherookorelly, 22–11–1799. Barry Close, now Resdt. in Mysore, was with the army [91].

[1] River water at Calcutta must have been horribly polluted [387]. Gurwood, I. [2] Gen. Harris [I, 351; II, 275]. [3] PS. to Lord Mornington, GG., the eldest bro. 1798–9; Lt Govr. Ceded Provinces, 1801–2 [26]. [4] Gurwood, I. [5] Sir David Baird (1757–1829) *DNB*. [6] Sinha (53); cf. *EIMC*. III (100); Lushington (211); Hook (189); Williams; Mackenzie's Journal, BM Addl MS. 13663 (59–60), gives account by Lambton himself. [7] Sinha (76). [8] BM Addl MS. 13663 (138). [9] cf. Gurwood, II (53–122). [10] 48 N/7.

Though his journal is entirely taken up with mil. and pol. matters, and makes no mention whatever of maps or svys., it is more than likely that he and Wellesley must have lamented the complete lack of maps or the smallest geographical knowledge of the country, and it was now that Lambton conceived his scheme of a General Survey that should extend right across the Peninsula, based on the most scientific principles. He had already acquired a good theoretical knowledge of trgn., geodesy, and astronomy, and in a letter to the ASB. in 1800, he discusses the work of the Ordnance Survrs. in Great Britain, "and I own that it was from reading the details of their operations I was first led to consider the subject. The publications of the late Gen. Roy relative to his measurements on Hounslow Heath and Rumney Marsh, with his continuation of triangles[1]; and the later accounts of a trigonometrical survey along the southern and eastern coasts of England by Lieut. Col. Williams, Capt. Mudge, and Mr. Dalby, are works which I consider as a treasure"[2] [250].

Though he had thus acquired a complete mastery of principles, he had never, so far as we know, had anything to do with svys. in America after 1785, nor any prospect or intention of such employment. ... As stated in *RM Cal.*: "In the latter part of this officer's time in America, he had taken a decided turn to scientific pursuits, little thinking that any other advantage was to accrue from them than the discovery of truth, and the delight which mathematical investigation affords to a speculative mind". In fact we owe the conception of the Great Trigonometrical Survey of India to the entirely fortuituous circumstance that led Lambton, with his strange love of geodesy, on a tour through the completely uncharted territories of Mysore [9, 233, 312].

On his return to Seringapatam with Wellesley, Lambton proceeded to the Presdcy., and submitted his proposals, which he had already discussed with Wellesley and probably Close, to the secretary Josiah Webbe, who passed them to Mackenzie, asking him to advise Close how they would affect his own plans for the svy. of Mysore. Mackenzie's letter to Close, 6–12–1799, is the earliest reference we have found to Lambton's proposals [233], and our next is a letter from Wellesley to Close, 3–1–1800, saying that Govt. had expressed full concurrence, and had told Lambton to write to Calcutta for the insts. he wished to buy from Dinwiddie [231, 233, 251–2, 396]. Official sanction to Lambton's new appt. was issued 6–2–00, and his detailed plan was submitted four days later [234, 251–2].

Warren says that "the first idea was...confined to the throwing a series of triangles across from Madras to the opposite coast. ... His plan being laid before Colonel Wellesley, the latter handed it up to Government, with his recommendation and support. Mr. Josiah Webb, then Secretary to Government, had also a favourable opinion of the undertaking; and, in consequence of the representations of these two gentlemen, the first patrons of the project, Lord Clive and his Council sanctioned it, & directed Major Lambton to prepare the necessary estimates"[3].

A summary of his professional work is given in Ch. I [3–4], with fuller details in Chs. XVII and XVIII [234–67]. In Ch. VIII a full section is given to refute Markham's statement that Lambton and Mackenzie did not work harmoniously together [115–21, 207]. Accounts are given of his assts. and personal est. [322–3, 333–5, 346, 359, 369–72].

We hear very little of Lambton being troubled by the climate, or out of health. In that respect he was far more fortunate than either his contemporary Mackenzie, or his successor Everest, both of whom were constantly racked with fever or other troubles.

Lord Valentia [410] tells of a meeting at Bangalore in March 1804; "Hearing from his servant that Major Lambton was encamped without the town I preferred paying him a visit to going into it. A dispute having arisen between Major Lambton's followers and some of the towns-people, I amused myself with attending to the debate. Major Lambton has been for some time employed in measuring 6 degrees to the north of the line within the tropic, to compare the degrees there with the degrees to the south as measured by the Spanish and French in S. America. He is extending his labours across the peninsula, which will add much to our geographical knowledge. He informs me that he found many places in the Carnatic more inaccurately laid down than in the interior of Mysore. In placing Arcot there was an error of nine miles [104, 277, 285]"[4].

We have already told of Rennell's first criticisms of his proposals [I, 376; II, 251, 264], and of the efforts of the finance com. to reduce his expenditure [265, 334–5], but on the whole he was given all the help he wanted, and, when making his first suggestion for the transfer of his svy. to the control of the Supreme Govt., he acknowledges "the liberality of the Government of Ft. St. George for their uniform support and acquiescence to every proposal which I have had the honour to lay before them [266]"[5].

In a pubd. report he writes; "The work is now grown to a magnitude far exceeding what was first proposed[6], and will, I hope, be adopted as a foundation for a more finished Superstructure in times to come. The task has been an interesting one, and by no means arduous. Freed from restriction of every kind, and permitted to act under the most liberal conditions, I have been enabled to obviate every difficulty which otherwise must have embarrassed my exertions, and defeated the ultimate object of my labours"[7] [226, 290].

After his first year's recce. in Mysore, and nearly two more years on essential preliminary work between Madras and Cuddalore on the E. coast, he left Madras in Oct. 1803, and spent the next three years on his first great achievement, the bridge of triangles across the peninsula from coast to coast [100, 123, 124, 212, 238–41, 379]. His general *Notices of Malabar* were pubd. 1844, *Bo Geo Soc.* I. 56 (10).

He spent the next twelve months at St. Thomas' Mount grinding out his compns. and then worked south till held up near Tanjore by an accident to the great theodolite [3, 241–2, 253–4, 317]. Spending several months at Trichinopoly over the repairs, he set out again in October 1808, to continue his great arc south to Cape Comorin [127, 139, 145, 242–5].

From now on he deputed more and more of the actual trgn. to his assts., and even allowed his senior sub-asst., Joshua De Penning, to observe at some of the southern stations of the great arc [243, 394–5]. He devoted most of his own energies to the astr. obsns., the meast. of bases, and compns. [194, 255–7, 260–4].

[1] Roy's *Account* was pub. 1787. [2] *As R.* VII., 1801 (312–21) *v.* Mudge's *Trigonometrical Survey of England and Wales, 1784–1801*, 2 vols. London, 1799. [3] Warren (76). [4] Valentia, I (355). [5] BPC. 11–12–07 (3). [6] Four officers of MMI. joined him in Dec. 1807 [242, 322]. [7] *Account of the...operations in crossing the Peninsula. As R.* X, 1808 (290–9).

After assisting in the forcing of the Aramboli Lines as a mil. engr., 10–7–09 [132, 242–3], he spent most of 1810 on maps and compns. at Pondicherry, where his son was b. 12–7–09.

He moved N. to the Ceded Dists. early 1811, and when at the end of the year the last of his mil. assts. were withdrawn after taking trgn. down to the coast between Guntūr and Masulipatam, he left nearly all the trgn. to De Penning. The last series he obsd. himself was the section of the great arc between Gooty and Bidār, 1813–4 [4, 130, 158, 164, 245–9, 292].

Confusion has been caused regarding his rank, on account of his appt. as Bde. Major of King's troops, Madras Presdcy. whilst still a subaltern. He was confirmed in this appt. by GO. of 2–9–1799, and held it till 21–1–07, when he was promoted Capt., with rank from 25–6–03. Another officer had been appd. to act as Bde. Major "with the usual allowances of that situation" when Lambton was placed on svy.

In 1808 he purchased his step to Major, and John Orrok writes[1]; "On the 1st March last [1808] Major Quin declared that he would sell out provided he got £ 5,000 sterling. Capt. Lambton agreed to give £ 3,000 for the Majority if I would give £ 2,000 for the Company, ... £ 500 more than the regulation".

In 1811 Lambton pointed out that the 33rd was about to leave India, and "it becomes necessary for me to make my arrangements for accompanying it, unless it should be the pleasure of Government that I remain in India with a view to prosecute the survey now under my direction, which must inevitably fall to the ground in the event of my relinquishing it. Should you wish, Sir, that it be continued, I...hope that there will be no objection on the part of this Government to signify...the reason for wishing me to remain in India. ... In case of being promoted in the 33rd Regiment after it arrives in England, I have engaged to go on half pay, which will be attended with another reduction of income, but will leave me entirely free to carry on the present work without interruption. ... I shall on that account forego all regimental advantages, and be thrown entirely out of the line of active service in my professional capacity.

"I shall leave it to...you, Sir, ... to decide what may be reasonable for a person...conducting a work of great national importance, and now grown to a great magnitude. My salary for these many years past has been but two hundred and eighty Pagodas per month [333–4]. During the time I have been employed, I was nearly six years a Subaltern, two a Captain, and three a Major, and my full pay and half-batta as Major, added to the above salary, amounts to only Four Hundred and thirty-six Pagodas. I have never yet applied for an addition of income"[2].

His salary was thereupon raised to 400 *ps.* a month, besides est. and pay of rank, and was met by the Company after the departure of the 33rd [304–5, 335].

After closing his Great Arc at Bīdar, March 1815, Lambton settled down at the French Gardens at Hyderābād [249, 262–4, 394] to work up results with the asstce. of his four sub-assts. No further field-work was possible till after the close of the Marātha War of 1816–8. In reporting on the prospects of his svy., he writes, 15–9–15 ; "The most serious impediments that I shall have to apprehend to the northwards will be from the gangs of plunderers which infest that quarter when the Army is not in the Field ! It will, however, be a desirable object towards promoting general geography, as well as for giving a basis for local surveys to extend this work as far to the northward as possible, and to enlarge it...so as to take in all the great military roads leading from the Ceded Districts to Jaulna, Ellichpoor, Nagpoor, etc. ; and when that shall be completed, and the triangles extended from Masulipatam to Point Palmyras, all which is a part of the work before me, I trust that I shall have contributed my share towards the advancement of Indian Geography.

"Should I live to accomplish all that, there will then be, besides the great extent of Territory already comprehended, a foundation laid for extending this survey over the whole of the Deckan, through Orissa and the more Northern Provinces, through the Marhatta dominions, and finally into the Upper Districts of Hindustan ; and I sincerely hope that, after I relinquish it, some one will be found possessing zeal, constitution, and attainments, wherewith to prosecute it on the principles already followed. It would indeed be gratifying to me if I could but entertain a distant hope that a work that I began, and which will then be brought to so considerable a magnitude, should at some future day be extended over British India"[3].

At this time Lambton was at least 59 years of age.

LAWTIE, Peter. Ben. Engrs.
b. 25–2–1792. d. 5–5–15, Ratangarh, Bilaspur State, Simla Hills[4].

Ens. 15–12–08 ; Lieut. 28–12–12.

Only son of George Urquhart and Sarah Lawtie, of Calcutta ; his sister, Harriet Sarah, m., 7–1–11, Lt Col. Geo. Hickson Fagan, Ben. Inf., then AG. Bengal [41].

ed. RMA.

Appd. Fwkr. Art., tr. to Engrs., 19–12–09.

DDn. 126 (134), 9–11–12, CE. reports ; "Ensign Lawtie of the Engineers returned from Callinger[5] to Delhi. I have but little personal knowledge of this young officer, but his reputation stands high. Colonel...Kyd mentioned him as giving great promise, and the Revd. Mr. Thomson [192 n.7] says he is eminently qualified as a mathematician".

1810–2, at Cawnpore ; survd. cants. [28].

1812–4, at Delhi, survd. city [61] ; Nov. 1813, survd. route of Gen. Marshall's force, Rewāri to Bahādurpur and back to Muttra[6] [312, 398].

Nepāl War ; BGO. 15–11–14, appd. Fd Engr. & Survr. to 3rd or NW. Div. under Ochterlony ; kept fdbk. of svy. Nov. 1814 to Jan. '15 [90]. Distinguished himself at sieges of Nālāgarh and other hill forts[7] ; ADC. to Ochterlony.

CG. 1–12–14, Ochterlony writes to AG. telling of the capture of Nālāgarh ; "I have feebly expressed my sense of Lt. Lawtie's services, whose youthful energy carried him to points which I could not have ascended, and whose active and intelligent mind furnished me with the most useful information".

Mentioned again in dispatch of 17–4–15 for his "characteristic zeal and activity" with the night attack which led to capture of Malaun[8].

[1] *Orrok* (103) ; John Orrok, of 33rd Ft., son of Col. Wm. Orrok, of Mad. Est. [2] DDn. 62 (109), 21–2–11 ; MMC. 5–3–11. [3] *As R.* XIII (7). [4] Lloyd (116) records, MI. ¼ m. E. of Ruttunghur, of Lawtie and Chas. Lionel Showers ; latter kd. 15–4–15 at storming of Malaun ; son of S. H. Showers [I, 383]. [5] Kālinjar, 63 C/8. [6] Fdbks. MRIO. M 385, 547, Map, ib. 30 (89). [7] cf. Fraser (18, 37). [8] 53 A/16 ; *Nepaul Papers* (593, 602, etc.).

CG. 25–5–15, pubd. a private letter telling of Lawtie's death; "He was unwell when he left us in the end of last month for the purpose of examining some positions, ... and he concealed his indisposition from a dread that the General would, had he known of it, have prevented him from proceeding. ... On 27th he was removed to our post at Rattungur, where he received every possible medical care & attention. But his disease was of too long standing to admit of remedy, and about 7 o'clock this morning we lost in him one of the most gallant & worthy young men that ever existed". ...

Dett. Orders. "The Maj. General requests that the officers will wear mourning for one month. ... The disease which put an untimely end to Lt. Lawtie's life was a malignant fever".

CG. 2–6–15, long ob. notice; MI. St. John's ch. Calcutta.

LENN, William Charles. Bo. Inf.
bapt. 13–5–1792. d. 29–8–18, Broach.

Ens. 3–5–11; Lieut. 1–11–17.

Son of John and Elizabeth Lenn.

m., Surat, 4–11–16, Elizabeth Reynolds, niece of Gen. Charles Reynolds [I, 378].

Bo RC. 20–10–12, appd. Asst. Survr. Broach svy. [323], remaining there till death.

LETHBRIDGE, Christopher.
bapt. 12–2–1789. d. 18–10–68.

Lieut. 17–7–05 ... Lt Col. 23–8–34; ret. 2–1–43.

Son of Christopher and Jane Lethbridge.

1st wife, Petronilla, d. 30–8–16 aged 20; m., 2nd, 4–4–39, Emma Martha, dau. of Wm. Mackie of Sidmouth.

April 1806, MMI., cl. II [320]—1810, under Garling on Kālahasti svy. [127, 399]—1811–2, on Goa svy. [156–7, 164, 156–7]—MMC. 10–12–11; "Is at present in good Health, but is employed in the interior, where he is exposed to considerable risk in contracting the fever". MGO. 10–7–12, "Relieved... from 30–6–12, but permitted to remain at Goa until close of Western Monsoon before joining Corps". Drew fair map of svy. [158 n.2; pl. 14].

1817–25, or later, in ch. forests of Cochin, Resdt. writing 29–11–17; "Lieutenant Lethbridge of the 11th Regiment, a zealous and deserving Officer, was for some time employed in superintending the forests of Cochin; but on the removal of his Corps from this Coast, his leave of absence could not without some difficulty be prolonged. The exertions of Lieutenant Lethbridge during the short period of time while he managed the forests of Cochin were so extremely useful that I am induced...to express a hope that he may be placed at my disposal...with a view to his being more permanently attached to his late charge. This arrangement will be satisfactory to His Excellency the Rajah of Cochin, who is anxious for the improvement of all the resources of his country"[1]. His services were placed at the disposal of the Resdt. under MMC. 14–1–18 (41).

LEYDEN, John[2]. Mad. Med.
b. 8–9–1775. d. 27/28–8–11, Cornelis, Java, of fever.

Asst. Surg. 1–1–02.

Son of Scottish border shepherd; of Denholm, Roxburgh.

DNB.; DIB.; Ben. P & P. LII. 104 (67); *Poetical Remains.* Rev. J. Morton, London, 1819; Crawford II (157).

ed. Edinburgh; Licensed preacher, Ch. of Scotland, May 1798; MD. Edinburgh; LRCS. St. Andrews.

Poet; Oriental Linguist; "the renowned Orientalist, formerly the friend and literary associate of Sir Walter Scott"[3].

19–8–03, arrd. Madras; MGO. 14–1–04, appd. Asst. to the Mysore svy. in succession to Dr. Heyne, "to afford medical assistance to the establishment, and to prosecute enquiry into the Natural History and Productions of Mysore" [114–5, 379–80, 406]. Salary 50 *ps.* pm., in addition to pay and allces.

DDn. 43 (103), 12–4–05, under med. treatment from Nov. 1804; leave to Malabar Coast, and then sea voyage to PWI. reaching Calcutta Feb. 1806.

BPC. 2–10–07 (3), services lent to Bengal for appt. as Examiner in Hindustani and Asst. Sec. at Ft. Wm. Coll.; BPC. 5–10–10 (9), appd. Assay Master, Calcutta Mint.

1811, with expn. to Java as Malay interpreter to Lord Minto, who describes him as "a perfect Malay. ... Dr. Leyden's learning is stupendous, and he is a very universal scholar"[4].

Raffles writes; "The bard of Teviotdale...expired in my arms a few days after the landing of the troops. From his profound acquaintance with eastern languages and Indian History; from the unceasing activity of his great talents, his other prodigious acquirements; his extensive views; and his confident hope of illustrating national migrations from the scenes he was approaching, much might have been expected"[5].

Leyden's collection of India mss. purchased by EIC. is described in JMLS., 1847.

MI. at Denholm.

LINDESAY, George. Ben. Engrs.
b. 6–2–1792. d. 10–10–21, Hooghly R.

Ens. 28–10–09 ... Capt. 1–10–19.

Son of Patrick Lindesay, of Coats, & Mary Ayton his wife; bro. of H. B. Lindesay, Ben. Inf.

ed. RMA.

Hodson, III (52).

DDn. 128 (125), 10–1–13, survd. Mirzāpur & environs, Nov. 1812—DDn. 131 (21), 9–2–14, Capt. & Fd Engr. to the Rewah Dett. under Lt Col. Adams[6]; survd. Chunār to Rewah, and Rewah Territory, Nov. 1813 to July 1814; sd. Fdbk., MRIO. M. 376, Benares, 9–9–14—MRIO. 185 (4), svy. of Tarra cant. Mirzāpur Dist.

The maps of Rewah, or Baghelkhand, completed partly from native infn., are well drawn; MRIO. 82 (33) has artistic little titlepiece [47].

Nepāl War, Dinapore Div., Asst. Fd Engr.—DDn. 131 (137), 23–3–15, Asst. survr. Gorakhpur—BMC. 1–3–16, Survr. to Ochterlony's column—ib. 11–10–16 (100), submitted to SGO. "a variety of drawings of the Gurkha Stockade, Muckwanpoor, and Snow Mountains, executed in a very elegant style...which must have taken much time and perseverence [43]".

1817, Supdt. of Embankments; 1819, at the Presdcy. making svy. of Suburbs, *Ben. Regr.* 114 (432).

1821, drowned near Kijri, Hooghly R., "through the upsetting of a pinnace". MI., S. Park St. cem. Calcutta.

[1] MMC. Dec. 1817. [2] John Leyden, g-nephew, of Burma Frontier Service, was DC. Myitkyina at Japanese occupation, May 1942. [3] *Serampore Letters.* [4] *Minto* (253–5). [5] Raffles, I (vii). [6] J. W. Adams (1764–1837); Ben. Inf., Hodson; Feb. to May 1809, survd. route Hyderābād–Saugor–Kālpi–Cawnpore, fdbk. DDn. 162; comdg. Rewah Fd. Force, 1813–4; later M Gen.; GCB.

LLOYD, William. Ben. Inf.
b. 29–12–1782. d. 16–5–57.

Ens. 6–11–1800 ... Maj. 22–10–24; ret. 14–7–25; Hon. Lt Col. 28–11–54.

Son of Richard and Mary Lloyd, of Plas Madoc, Wales. Father of George, probably a nat. son, b. 17–10–15, who ed. his journals, 1840, and d. 10–10–43, nr. Thebes, Egypt, from gun accident.

Kt. 18–7–38. *Landed Gentry; EIMC.* III (146–67); Lloyd; Hodson, III (68–9).

July 1804, comdg. marines in *Bombay* frigate against Muckee[1], on W. coast of Sumatra.

25–2–06, comdg. escort to Resdt. Nāgpur, left Hazāribāgh 25–2–06, survg. route to Nāgpur; continued svy. in Nāgpur territories with help of *harkaras* till such asstce. was prohibited [5, 52–3, 312, 328, 353–4]. Resdt. writes, 14–12–22; "He has at various periods of public exigency afforded both to the Resident, and to every commanding officer of troops at Nagpur, routes and sketches of considerable moment to the prosecution of military operations. ... The maps have been extremely useful to me in tracing the movements of the Pindaris, and counteracting their measures. ... The Nagpore Escort bore a distinguished share in the Mahratta War of 1817, and particularly at the battle of Seetabuldee, in which Capt. Lloyd was 4 times wounded"[2].

Has left, MRIO. 188 (16), an excellent map of Nāgpur, 600 paces to inch, with account of action at Sītābaldi, 26th & 27th Nov. 1817[3].

1820, on disbandment of escort remained attd. to Resdcy.

Jan. 1821, visited Hardwār; 1822, made interesting journey into hills through Simla and Kotgarh to the *Boorendo* or Baran Pass, which leads from upper Tons to Baspa Valley. Leaving Cawnpore 22–12–21 with his 6-year old son George, he spent a month at Gwalior where he was joined by Robt. Close[4], the Resdt., and reached Kotgarh on 15th May, being "greeted by my friend Captain Patrick Gerard, who is in command of a portion of the Goorka Battalion which is stationed at this remote point. He employs his leisure hours in scientific observations on the meteorology of these elevated countries, as well as in making collections of plants and minerals. His brothers, Captain Alex. Gerard, and Surgeon James Gerard, together with Lieut. Osborne[5], now form our delightful party".

Lloyd's diaries, later ed. by his son, are full of entertaining and picturesque detail;

At Simla, 6th May, "The mountain air seemed to have instilled ether into my veins, for I felt as if I could have bounded headlong down into the deepest glens, or sprung nimbly up their abrupt sides with a daring ease".

On a climb from Narkunda, 13th May, "Immediately we reached the first patch of snow we pelted each other, to the great amusement of our servants, and particularly my son. He walked almost the whole way, and when towards the end he became tired, the good-natured Hill-porters carried him on their backs".

At Kotgarh, 15th., "We were visited...by the son of the Rajah, ... a handsome boy, ten years old, who is a great and deserved favourite of Captain P. Gerard. ... He...soon formed an acquaintance with my son in whom he found a joyful playmate".

On the road to Sustwar, 9th June; "The valley of the Pubbur was insufferably hot. ... I was unwell. ... We began by ascending. ... Elevations of between 8,000 and 9,000 feet. ... The villagers were frank and kind to me. Many of the women were very handsome. Their complexions are fair and blushing. All the hamlets in the Bussheer Rauj are guarded by a breed of very fierce dogs, peculiar to the mountains. ... The path skirted the edge of the highest cliffs I ever saw. The Pubbur foamed in the narrowed glen 4,000 feet below. ... My head became slightly affected by dizziness, and I was consequently obliged to take hold of the guides' hands till I had passed. ...

"Sustwar is a small hamlet on the mountains, ... looking up towards the Himala. ... We saw two very beautiful girls here. ... We feasted upon straw berries on the road, and singularly enough, I had not been long at Sustwar before my indisposition vanished, and I felt strong and active again"[6].

1823, returned to England on furl.; settled at family estate, Brynestyn, Denbighshire; Maj. Comdt., Denbigh Yeomanry.

LOCKETT, Abraham. Ben. Inf.
b. 21–6–1781. d. 10–5–34, Cape Town.

Ens. 19–11–01 ... Lt Col. 21–1–29.

Son of John Lockett.

m., Trincomali, Ceylon, 14–3–17, Mary Barnett, probably sister of Hugh L. Barnett, Ben. Inf. (Hodson).

Hodson, III (71–2).

MRIO. 541; DDn. 270, Feb. to March 1804; DDn. 67 (337), 28–8–04; April & May 1804, survd. marches Delhi to Sahāranpur, and on to Hardwār, Rāmpur, & Thāna.

1827, AGG. Bharatpur; April 1832, AGG. Rājputāna States; Nov. 1833 leave to Cape on mc.

LOFTIE, William Henry. Mad. Inf.
bapt. 24–5–1781. d. 22–3–16, in England.

Lieut. 15–12–1800 ... Capt. 15–3–10.

Son of Wm. and Hester Loftie.

Before 1810, as Lieut. and Adjt. 2/19th MNI., survd. route from Bellary to junction of Varada and Tungabhadra rivers, and to Goa. In his svy. of Savanur[7], 1818, Garling used Loftie's surveys "because I have great confidence in their accuracy, from the repeated proofs I have had of the general correctness of that officer's surveys"[8].

LOW, John. Mad. Inf.
b. 1788. d. 10–1–80.

Lieut. 17–7–05 ... Lt Col. 21–2–34; Gen. 1867; ret. 18–1–67.

Son of Col. Robert Low, of Clatto, co. Fife; bro. of Wm. Low (1792–1874) Mad. Inf [320].

Supreme Council, 1853–8; KCB. 1862; GCSI. 1873.

DNB.; *DIB.*; *Oriental Club*; Ursula Low.

April 1806, MMI., cl. II [320]; MMC. 10–1–09, recdd. by QMG. as "extremely well qualified to be employed on Survey with the Poonah Subsidiary Force". MMC. 29–1–11 Employed in QMG.'s office "arranging Survey records" till appt. discontinued [301].

From 1825, Pol. Dept.

LUTWIDGE, Skeffington. Mad. Inf.
b. 23–5–1779. d. 3–2–54.

Ens. 4–8–1798 ... Bt. Maj. 4–6–14; ret. 29–3–16.

Son of Henry and Jane Lutwidge, of Lancashire; ed. St. John's Cambridge.

m., Pondicherry, 19–3–11, Mary Margaret, dau. of Gen. Lockhart of co. Lanark.

Svys. in Berār, date unkn.; "Jaulnah–Gangree–Chikergaum; Ajuntah to Milkapoor" [134, 165].

[1] probably Moekomoeke, 3° S.; 101° E. [2] EIMC. III (151). [3] cf. *Imp Gaz.* XXIII (49–50). [4] Maj. Robt. Close (1785–1857); Mad. Cav. 1801–26; nephew of Sir Barry Close, and is 1st cousin to Valentine Blacker [382]. [5] Henry Roche Osborn (1798–1849) Ben. Inf. 1821–49; 1st Nasri Batt. 1822–3. [6] Lloyd, I (139, 160–1, 166–7, 225–9). [7] 48 N/5. [8] DDn. 185, M 537, 2–3–18.

MACARTNEY, John. Ben. Cav.
b. 6-8-1781. d. 29-4-11, Meerut.

Corn. 30-12-1800; Lieut. 11-3-05.

Son of Rev. Dr. George Macartney, LLD. JP., vicar of Antrim, Ireland, and Mildred Brown his wife.

BMC. 1-1-07 (57), writes from St. Dennis, Bourbon[1], 4-10-06, "Having gone to sea for the recovery of my health [BGO. 4-3-06], I was captured on board the Henry Addington by a French Privateer on the 27th of May [1806] on the West coast of Sumatra, but was allowed to go on shore at Nuttal in the long boat with the Captain and the Officers of the Ship, from whence I went to Tapianoly, as being a place more likely to procure a passage from, to Bengal.

"On the 25th of June I took my passage on board the Warren Hastings bound to Cadday & Bengal; having sailed from the former place on the 9th of July for Bengal, I was unfortunately again Captured by the Sumillante, French Frigate, near Good Fortune Island on the 11th of July, from whence I was carried to St. Paul's in the Island of Bourbon, where I arrived on the 8th of September. ... I have now applied for leave to go to the Isle of France by the first opportunity, where I hope soon to get exchanged and return to my duty".

Foster (28-9) and VM exhts. 1365-6 show fight between *Warren Hastings* and *La Piedmontaise*, 21-6-06[2]; the Indiaman was recaptured later by British cruisers, and the French frigate was herself taken in action in March 1808.

The French navy was very active in the Indian Ocean, and captured many British ships, until Bourbon and Mauritius were occupied in 1810 by expn. sailing from Madras[3] [223, 253, 284, 320].

BMC. 9-6-07 (23), arrd. Calcutta, 23-6-07, "Having been made prisoner and kept at the Island of France & Bencolon[4] for 8 months, at the expiration of which time I was, after a great deal of trouble, & having obtained a sick Certificate, permitted to return to India, on condition that... two French Serjeant Prisoners of War at Poonamallee should be returned in my room, ... I request to know if the exchange can be made, so as to allow me to return to my duty with propriety. I have the honor to return the parole I have signed. ... Left Isle de France on 7th of May".

1808-9, comdd. escort with Elphinstone's mission to Peshāwar, giving up "the Quarter Mastership and the command of a troop" to do so. Survd. route with Tickell, and compiled map of Punjab, Afghānistān and surrounding regions [65-7, 218-9, 227, 270-1, 289, 310].

Elphinstone pressed that he should draw full allces., "Lt. Macartney's chief merit consists in his general Map, which has been formed on his own observations, joined to the information derived from a great number of travellers of various nations & languages; the difficulty of obtaining such persons without giving cause for suspicion, ... as well as that of gaining information from them, may be easily imagined"[5].

BMC. 5-12-09 (176), appd. to svy. W. Jumna Canal, completing the fd. work by Dec. 1810, "with infinite industry in a masterly manner [67-9, 383]". His maps were left incomplete at his death, and there was some difficulty in clearing up his papers; no will was found till 1814, but probate was then granted on statement of accounts, dated Karnāl 17-6-10[6], endorsed, "Should I kick, all this with what property I may have...to my Sister". In submitting their claims, his father and sister write; "Many of his surveys were really his private property, and having by his Observations, Plans, and Drawings, &c., of the Isle of France while a prisoner on that Island, rendered the Government very useful and permanent service"[7].

McCARTHY, Jeremiah. Mar. Survr.
d., PWI. before Aug. 1832[8].

Bro., to Charles McCarthy, who predeceased him, leaving a dau. Mary; Jeremiah's son Thomas d. 11-2-1836, aged 43, "at his residence at Breach Candy"[9].

5-11-1799, appd. asst. to Upjohn on svy. of Chittagong coast [I, 65], on salary Rs. 300 a month. Svy. not being continued after Upjohn's death, June 1800, McCarthy was employed by Marine Bd. to svy. Hooghly R. "from Tolley's Nullah to Chitpoore Bridge", which he completed Feb. 1801 [10].

"Having almost exhausted my little finances in procuring Mathematical Instruments and other articles from England, ... I was obliged to have recourse to a Trading Voyage for my Subsistence"[10], and in his absence the svy. of Sundarbans coast was entrusted to Robert Knox [10-11, 411].

June 1803, McCarthy was given comd. of the gun-vessel *Scourge*, and survd. the W. banks and creeks of lower Hooghly [11-2]; after a few months he was moved to the Orissa Coast, taking supplies for Harcourt's force and then, in company with Knox, continued svy. of coast and estuaries [23, 383].

In pressing for increase of pay he says that the *Scourge* was "ordered to Ballasore...for the purpose of covering the landing of the troops if there should be an occasion, and, tho' no opportunity had offered of making use of the guns on board of her against the Enemy", he was "not totally underserving the honor of a Commission in the Marine"[11].

A year later he writes that "I have, since 1st June [1803], and am still, employed in the Double capacity of Marine Surveyor and Commander of the...Gun Vessel Scourge, a part of that time acting against the Enemy's of the State, and in checking and Quelling the late insurrections in the Province of Cuttack, as well as occasionally rendering assistance and protection to the Vessels sent with Stores by the Government in Calcutta"[12].

In supporting his claim Harcourt urged the value of his "Report of the guidance of Mariners", and his obsns. for position of Point Palmyras [11, 391].

After the mar. svys. had been closed down to the end of 1805 McCarthy was appd. "Surveyor to the Government of Prince of Wales's Island", proceeding there in March 1806 [12].

MACDONALD, John. Mad. Inf.[13]
b. 1782. d. 11-6-30, Tabriz, Persia.

Lieut. 21-9-04; Capt. 14-4-18; local Lt Col. 1826.

Son of John Macdonald, controller of customs, Borrowdounness, NB., and Mrs. Amelia Kinneir, of Sanda I.

m., Amelia Harriet, 3rd dau. of Lt Gen. Sir Alexander Campbell, Bart., C-in-C. Madras 1821-4, whose elder dau. m. Sir John Malcolm, 4-6-07. Amelia accd. Macdonald to Persia in 1826 [*inf*], and dsp. 16-10-60.

Kt. Bach. 17-11-29; CB.; KLS.

Appears in *DNB.* under his mother's name, viz., Sir John Macdonald Kinneir, of Sanda, but no record of his assumption of such name has been traced. Appears as Major

[1] now Réunion, 21° S., 56° E. [2] Does not fit with Macartney's story [*sup*]. [3] Minto (242). [4] Benkulen, Sumatra, 4° S.; 102° E. [5] B Pol C. 12-12-09 (1). [6] Ben. Wills, 1814. [7] BMC. 31-5-16 (74). [8] PWI. Wills, II (77). [9] *Bo. Cal.*, 1837. [10] Petition to GG., 11-4-03; BPC. 21-4-03 (13). [11] B Pol C. 5-7-04. [12] BPC. 19-9-05 (14, 22). [13] not the J. Macdonald at MMI. from July 1815 [321].

Kinneir in Cary's *Map of Countries between India and Europe* pubd. *c.* 1824; MRIO. 97 B (3).

From April 1808, with Malcolm for mission to Persia [175, 339]; BSC. 10–4–09 (26), supernumerary Pol. Asst., Persia.

March to May 1810, with Monteith survd. line from Bushire to Basra and then to Shirāz, taking 3 months; "The information which Capt. Macdonald has obtained...will afford great information regarding the state of the Southern part of Persia". June to Sept., compiled memoir on Persian geography [280]. Proceeded on leave with Monteith to Europe, travelling overland to Aleppo with Malcolm's despatches; reports to Malcolm from Baghdād, 21–10–10;

"I am excessively sorry to have occasion to notify you the loss of our packets. I was attacked by a party of Arabs within a day's March of Heit, on my way to Aleppo; the party amounted to only eight persons, but my fine attendants were so cowardly or so treacherous that they immediately fled, and left Joe and myself in the lurch. The Arabs struck me off my camel with their spears, stripped us of our Cloaths which, together with our little property, they carried off in triumph, leaving us in the Desert, where we should probably have perished for want of water, had not one of our own men, more attentive than the others, kept us in sight. We resolved to return to Bagdad, and arrived here last night in a most deplorable condition, & poor Joe[1] has been ill ever since, and is now unable to rise from his couch. ... I lost property to the amount of two or three thousand Rupees, and Bills for seven thousand; however, I do not mind this, provided the papers are forthcoming. ... P.S. The villains have scratched me on the hand with a spear, yet severe enough to prevent me from holding a pen for some time to come"[2].

CD to M. 21–10–12 (114), Directors write that "We have permitted Lieut. John McDonald...to visit the Southern parts of Asia Minor, Mesopotamia, and Kurdistan and of the unexplored provinces of Persia; in consideration of which undertaking, we have granted him an allowance of Rs. 1,400 per month for two years (should that service continue so long), to commence on his arrival in Turkey. His usual pay is to continue till his arrival there". 3–2–15, Macdonald reported his return to Madras "from the Survey in Asia Minor and Persia, in consequence of having been appointed Town Major of Fort St. George. ... The whole of my baggage having been plundered by the Arabs in the Persian Gulph"; which possibly refers to a second disaster[3].

1824, appd. envoy to Persia; the mission assembled at Bombay in May 1824, but was there held up "waiting advices from England. ... In March 1826...Col. Macdonald...embarked in the Tamar frigate with his lady, and after a prosperous voyage arrived at Bushire"[4].

MACDOUGALL, William. Ben. Engrs.

b. 6–7–1776. d. 16–9–07, Calcutta; MI. S. Park St. cem.

Ens. 15–1–1799; Lieut. 15–4–06.

Son of Allan Macdougall, writer of the signet, Edinburgh, and Margaret his wife.

Hodson, III (130).

1802–3, on svy. of Cawnpore Dist.; tr. to Presdcy. before completion [27, 268–9]. 1803–7, Asst. Professor, Hindustāni, at Ft. Wm. Coll.

Made sketch of Qutb Minār near Delhi, reproduced in Francklin's *Life of George Thomas* [397].

BPC. 2–4–07 (65), to select site for lighthouse at Kijri on Hooghly R. [401].

Left Rs. 25,000 to Hester Maria, dau. of John Herbert Harington of Calcutta; she had arrd. Calcutta from England, July 1806, not having known Macdougall before.

McGLASHAN, Robert. Mad. Inf.

b. 21–12–1789, Kingston, Jamaica.
d. 10–7–18, Jālna; MI.

Lieut. 14–10–06.

Son of John McGlashan.

June 1807, MMI., cl. III [320]; from Jan. 1810 on trgn. under Garling [127]; Nov. 1810, to Goa, survg. route from Seringapatam through Coorg to Mangalore *en route*; on Goa svy. till Aug. 1811, when reverted to unit [321–2].

From Dec. 1814, Adjt. Trichinopoly Lt. Inf.

McKAY (MACKAY), Alexander. Mar. Survr.

b. 1750/1. d. 25–6–17, Calcutta[5].

DDn. 67 (155), 13–11–02, recdd. by SG., "well grounded in Mathematical knowledge", to be asst. to Knox on mar. svy., on salary Rs. 250 a month [10, 411]. After one season on the mouth of the Ganges, joined McCarthy, June 1803, for svy. of lower Hooghly [418].

Sept. 1803, with McCarthy in the *Scourge* to the Orissa coast, remaining on that svy. till end of June, when Mar. svy. was closed down [11–2]. BPC. 2–10–06 (39), conducted *Scourge* to Penang, returning himself to Calcutta.

BPC. 1–12–09 (54), appd. asst. to Marine Surveyor [296], "until the regular ones arrive from Bombay".

1814, employed as survr. by Collr. of Calcutta, and offered for sale "A New...Map of Calcutta", describing himself as "Marine & Land Surveyor" [18]. B Rev Bd. 18–3–17 (10), still employed under Collr. 24-Parganas, and described as "experienced".

MACKENZIE, Colin [I, 349–52]. Mad. Engrs.

b. 1754[6], Stornoway, Lewis I.
d. 8–5–21, near Calcutta. MI. Eye chyd. near Stornoway.

Ens. 16–5–1783 ... Col. 12–8–19.

SG. Madras, 1810–5; SG. of India, 1815–21.

2nd son of Murdoch & Barbara Mackenzie, of Stornoway.

m., Batavia, 18–11–12, Petronella Jacomina Bartels, from Trincomalee, Ceylon.

CB. 4–6–15; FRS. 10–6–19; *DNB.*; *DIB.*; *EIMC.* III; Wilson, H. H. 2nd edn.

Portrait, standing with 3 Madrasi members of his staff[7] [pl. 22], painted by Thos. Hickey, Madras, 1816; original at IO[8].: aquatint copies at IO.,—RE. Mess, Chatham,—and VM.; pubd. copies, *S of I Records* IX, 1914–5; Sandes I (164); *Ben P & P.* XXVII (60).

Account of early svys. given in vol. I of these *Records*, the most important being those of Nizām's territories 1792 to 1798 [I, 111–2, 116–8]. Constructed main siege batteries that led to capture of Seringapatam, 4–5–1799; prepared maps to help subsequent settlement of boundaries [I, 119], and returned to Presdcy. in July on account of ill-health [376].

"On my return to Madras, the Governor General... was pleased in the handsomest manner, without solicitation or any personal knowledge, to appoint

[1] apparently nickname for Wm. Monteith [qv]. [2] B Pol C. 9–2–11 (6). [3] ib. 25–2–15 (8). [4] Alexander (78–82). [5] *Cal AR.* 1818. [6] as determined by a former Provost of Stornoway. [7] Interpreters C. V. Lechmiah; Durmia, Jain; and *peon* Kistnaji; identity discussed pl. 22 n. [8] Portrait presented to IO. in 1822 by Henry Traill, probably of Paxtons, Cockerell, Traill & Co., EI. Agents of Hanover Sq., "My excellent friend Mr. Traill" of letter to Charles Grant, 7–7–15, preserved in Stornoway Town Hall.

me to survey Mysore, assisted by an establishment suited rather to an oeconomical scale of expenditure than to so extensive an undertaking [2, 91]"[1].

It was more than 6 mo. before Mackenzie completed his preparations. He writes, 9–11–1799, "I am the more desirous of going myself into the northern country...as it connects with the surveys I have been carrying on in the Nizam's Country. ... My anxiety would have induced me to enter on it immediately, did not the earnest advice of the medical gentlemen, and common prudence, weigh with me to postpone the attempt for some time longer ; for tho' my health is considerably recovered, and my complaint removed, a relapse would be not only dangerous, but entirely overthrow the plan of this Survey".

And again, 1–3–1800, "Having so early as the 4th Sept. been appointed to this duty, I think it incumbent on me to state the cause of my remaining here since that time, which, though originally owing to a serious illness incurred on the late campaign, has been latterly occasioned by being entirely occupied in preparing several charts, etc., relative to the late acquisition in Mysore ; in preparing the distribution and establishment of the several branches of this survey, and collecting various information...regarding those countries"[2].

As in all other official business Mackenzie made his preparations with great thoroughness, and his detailed Plan of operations [91–3, 124, 184, 210, 234, 251] covered all possible aspects of the work.

Leaving Madras, 10–3–1800, with Dr. Heyne [406], he picked up another asst. Thomas Arthur at Bangalore, visited Seringapatam, and moved up to the W. frontier ; "I reached Chittledroog on May 21st ; Soonda was in a very disturbed state ; on 2nd July met Col. Wellesley at Bednore, where the army was advancing against the Poligars"[3].

Arthur Wellesley was an old friend as they had marched up to Seringapatam together in 1799 [I, 351], and upon his advice Mackenzie spent the next two months surveying the Tungabhadra R., which formed the general boundary to the NW. [93–6].

Working down the river towards Sandur, the whole party was attacked with fever at the end of the year. Heyne had already gone off to Bangalore, and Arthur had to be sent to the Coast [376]. Mackenzie himself was as bad as the rest, and they would have been in a bad way if medical help had not been sent from Gooty by Gen. Campbell, comdg. in the Ceded Dists. [97–9, 360]. Reporting his visit to Gooty Mackenzie writes, 26–1–01 ;

"A very considerable degree of debility attendant on the fatigues of my journey, now near 12 months, and several attacks of the ague of late, prevented my earlier acquainting you of my returning to Raidroog on the 2nd of this month without losing a man, ... and, the prospect of the few remaining sick being on a fair way of recovery, I left them with most of my establishment at Raidroog[4].

"General Campbell had indeed strong claim to all the attention I could pay to his wishes, for, on hearing of my being taken ill at Comply, he immediately sent a surgeon and several dhoolies to assist ; these, arriving as I was on the point of leaving Camlapore[5], encouraged me to persevere to complete that part as much as possible". Again, 26–2–01 ; "My journey to attend General Campbell for a short time I also hoped would be conducive to restore my health ; I accompanied him from Gooty on the 19th to this place whence he returned on the 26th, after an inspection of the hill forts in the Ceded Dists."[6].

To Moncrieff he writes, 15–3–01 ; "I am now embarassed by my knees and arms being weakened and affected so as to impede my walking and writing. ... Do you hear from Colonel Reynolds ? Remember me to him, and acquaint me how he does" [I, 380][7]. Again, to Close from Bellary, 27–3–01 ; "I have been here upwards of a month, partly encouraged by the openness of the country and the fine air ; but of late owing to the weakness of my joints being followed by a contraction in the right knee. All the Surgeons have been urging me to go to the Coast, but, as the loss of time... would have been very detrimental, I still avoided this, in hopes of recovering strength enough to go on ; and I am glad to say that within these few days the contraction has suddenly gone off, and I propose leaving Bellary by the beginning of the month"[8].

About this time he was much worried by disputes with local officials over two or three matters which had gone wrong [98]. The Ceded Dists. had only just been taken over by the British [152, 181], and the local people were none too friendly or obliging. Mackenzie was far from well, and became very fierce over an aparently trumped-up case against a trusted servant, and a slanderous report made against himself [366–7].

Though obviously a man of powerful physique and immense energy, he suffered a great deal from the fevers and other ailments that are unavoidable in the Indian climate ; he had an immense enthusiasm for his work, and never spared himself. On the other hand his liability to sickness made him thoughtful of others, and he was always most considerate of the health of his assts. ; many examples of his care having been given elsewhere [359–62].

We have taken some pains to shew his friendly relations with Lambton, and their mutual co-operation, in order to refute a suggestion to the contrary[9] [115–21, 414]. We have told of the support which he gave to Lambton's first proposals [3, 115–6, 233, 236], and of constant exchange of infn., and at the same time have pointed out his great satisfaction with the agreement between his own work and the admittedly more refined work of Lambton's svy. [112, 121, 206–8]. He was delighted with their meeting in the field during Oct. 1801, and at the opportunity of seeing Lambton's great insts. in position, tho' these did not yet include the 36″ theodolite [118, 253]. He writes to Lambton, 14–9–1800, describing trouble with palanquin bearers ; "Till I came to Chitteldroog I had seldom occasion to use them, as I always rode or walked during the survey. Their life with me was therefore a very idle one, but being taken ill there, and detained a month, they deserted me the very night before I came away, at a time I was most in need of them".

He had the greatest regard for Mather, not only for his professional ability, but also for his sterling character, and he was much concerned that Mather drew far smaller allces. than the mil. assts. [204, 312]. He writes to him about his stores of wine ;

25–10–01. "By the bearer I send a basket of 16 bottles of Madeira, which I request your acceptance of. It was my intention to have mentioned it at meeting, but the hurry of the time prevented".

18–12–01. "I will be much obliged to you to get from Mr. Mathewson at Bangalore any old wine chest that can

[1] *v.* letter to Alexander Johnston, 1817 [I, 349 n.5] quoted H. H. Wilson. [2] DDn. 41. [3] ib. 11–10–1800. [4] Rāyadrug, 57 B/14. [5] Kamalapuram, 57 A/7. [6] DDn. 41. [7] DDn. 66. [8] DDn. 41. [9] Markham (73) & *DIB.*

contain 12 to 20 dozen of wine; perhaps I shall want two. I mean to leave my liquors, etc., packed up...till I return up the ghauts".

3–3–02, after his move to Madras; "I will send up a cart for one, if not both, the chests of wine so soon as I have occasion for them here; if some of those above the ghauts will not rather find it equally convenient and useful to take them.

No. 1		No. 2	
Old Madeira	7 dozen	Old Madeira	7 dozen
Port	1 dozen	Port	1 dozen
Ratafia, or Cherry Brandy	1 dozen	Ratafia, or Cherry Brandy	3 dozen
	9 dozen		11 dozen

19–4–02. "Being in want of wine here, I thought what I left at Deonelly preferable for its age, and therefore a few days ago sent my tindal with carts, cattle, etc., to bring down one chest of wine and a chest of minerals, stores, etc.; ... the other chest of wine I wish to leave, as I may want it, and it is of superior quality".

18–5–02. "I cannot comprehend how they came to send Port instead of Beer. I wish you had sent the claret along with the tindal, as that wine will not keep. As you are disappointed in the beer, I beg your acceptance of a dozen of Port, and if you cannot get the remaining claret, etc., disposed of at prime cost, ... or taken by the merchants at Bangalore for an equal quantity here, I beg the favor of your sending it by coolies to me here, as it is better than to have it spoil there"[1].

These large stocks of wine do not in any way indicate intemperance; the drinking of water was wisely avoided and, to quote Dodwell; "During the 18th Century Madeira was the popular wine for India, and was considered the only wine that improves in the Climate of India; consequently it is the only wine of which large stocks were to be found in private Cellars. The tossing of the sea voyage was thought to be particularly good for it. ... A present of a well-matured Madeira from Madras was thus a present worthy of acceptance by anyone. Madeira was drunk not only as a dessert wine, but also at meals mixed with water. ... The real rivals of Madeira were not to be found in other wines, but in malt liquor and spirits. Even in the 18th century the Indian demand was recognised by brewers, as is still shown by 'East India Ales' and 'India Porter'"[2].

Mackenzie now stayed down at Madras for over two years, being fully occupied in compiling maps and reports and making numerous copies [101–4, 275–6]. He took a house in Vepery where he had Warren to stay, writing; "You may find me at Kilpauk, to the North of Mr. Latour's, formerly Mr. Webbe's house, & on the banks of the Kilpauk Nalla. You will find a Room in the Bungaloe ready for your reception & every other convenience in my power to give. It is about three miles from the Fort. I need not tell you I will be glad to see you after so many fatigues gone through"[3].

He was called on to join the army moving against the Marāthas at the beginning of 1803, but Govt. refused to release him from the svy., and he writes to Arthur, 17–4–03; "I was particularly well pleased to find your usual attendant for some time had discontinued his visits (your fever I mean). I hope you have entirely got rid of this troublesome visitant, and will keep him at a distance by avoiding anything that may provoke a relapse, though I have had sufficient experience in my own person to know it is extremely difficult to do so at all times.

"I was near the end of February directed to join the army, provisionally, by the beginning of next month, but Government chose that I should remain to complete what I had in hand, and the General, I hear, has acceded to their reasons. I have been entirely passive in the business, and ready to go then or not, as might be thought most expedient"[4].

Before moving up to Mysore in 1804, he wrote to the GG., acknowledging the appreciation given to his maps and reports; "Tho' no one regrets more than I do the necessity that has for some time detained me from what might be considered as the proper Field of the Mysore Survey; yet, in fact, under the circumstances...the main design is not so materially affected by my absence from the mechanical part of the Field operations, which is compensated by the arrangement of a body of materials, that under the re-establishment of my Health will enable me more effectually to go into the remaining part of the Actual Survey, whereon the Assistants that could be spared have in the meantime added a considerable portion"[5] [203, 213, 220].

He moved up in June, and took an active part in extending the svy. to the W. Ghāts. Early in 1805, he survd. the Mysore–Coorg boundary, and assisted the Resdt. to settle several outstanding disputes [105–6]. In Aug. Arthur was removed from the svy. at the Resdt.'s request, as he was always in trouble with the local officials, either laying complaints against them, or being accused of bullying the villagers. It was typical of Mackenzie that he shewed Arthur little sympathy; he was extremely jealous of the good reputation of the svy., and, having a high personal sense of discipline, would have nothing to do with an officer[6] who failed to follow the Resdt.'s counsel [105, 107, 367–9, 376–7].

It is curious again that a year later when Mather's health broke down, and forced him to retire to the Coast, Mackenzie was only concerned that he should remain to complete the arrangement of his fd. svys., and records. We find not one word of sympathy or regret for the departure of his most trusted asst., after more than 6 years devoted work [109–10, 429].

From this time till the middle of 1807, Mackenzie was left with no assts. other than the young men from the obsy. school [343–6]. Setting these to finish up the svy. of S. Kanara and various scattered corners, he returned to the Presdcy., June 1807, and settled down to compile the immense amount of material now collected [110–2, 152, 275; pl. 11].

Owing no doubt to his Scotch nature, Mackenzie was not only a strict disciplinarian [314], but was most insistent on every right that he considered due to himself, more especially as regards pay and allces. His whole heart and soul was given up to his professional work as survr., tho' he included in this work, as belonging more personally to himself, the historical and archaeological researches that had been formally approved by Govt.[6]. He was methodical and thorough to the last degree, and was never to be hurried. He cared little for society [424], tho' he was warm-hearted, and made numerous friends; almost the whole of his time was given up to his svys., maps and scientific researches.

As early as 1796, after the death of Topping, he had pressed for the appt. of SG., being fully convinced that such an appt. alone would give the maps that were essential for admn. and mil. purposes [I, 264–5; II, 298]. He returned to the charge repeatedly, but it was not till 1810, through the intervention and advocacy of Sir George Hewett, that the opportunity and reward came to him [3, 161–1, 298–9, 423–4].

[1] DDn. 66. [2] Dodwell (178). [3] DDn. 66, 22–7–02. [4] ib. [5] to PS.; DDn. 43 (57), 1–5–04. [6] CD to B. 9–5–1797 (115); CD to M. 6–7–03.

For a few months in 1801 he had been the senior officer of Engrs., not only in Madras, but in the whole of India, and he was most disappointed that his charge of the Mysore Svy. was held to debar him from exercising authority in Corps matters. He writes to Gen. Campbell; "I feel too much what I owe to myself to wish to intrude in opposition to the authority of Headquarters, which I cannot help thinking new and contradictory to practice; perhaps there may be some mistake. ... For I am told that all officers, though employed on other duties, are still entitled to receive the monthly State of their Corps"[1].

We have already told of his deep disgust with the reduction of allces. and ests. on the svy., even after partial relief by permission to charge contt. expenses [112, 325, 329–31].

He continued his protests in Oct. 1903, and writes; "I have been repeatedly employed in my professional line, sometimes in situations confidential, & on duties properly appertaining to superior stations [I, 350; II, 427], and with no advantage beyond the allowance of my rank (save for a few weeks in the expedition to Manilla), & on such duties I had been repeatedly led to look for an ultimate remuneration in avowed & honourable preferment. ... From the duties to which my pursuits were directed for years, I was deprived of more advantageous employment; ... I might have with some justice claimed, especially after the severe campaign of 1799, ... some more profitable, tho' less conspicuous, employment than the Direction of this work". Since his employment in Mysore, other officers on normal employ had gained greatly on him in promotion and salary[2].

He tells Mather; "I have got my answer from Government; all very pleasant and satisfactory, but the salary cannot be restored without order from home"; and again "My salary has not been readmitted; I am however determined to persevere; it may be remedied in time"[3].

The Directors refused, however, to reconsider their orders; " We see nothing in the arguments urged by him to induce us to increase his personal salary"; but they did not object to the " additional expense... for the employment of writers, Draftsman, etc., beyond his fixed establishment " being charged in special bills[4]. Mackenzie continued to brood over this decision. In Oct. 1804, the Madras Council again asked the Directors to appt. him SG. [298], but about the same time refused to release him from ch. of the svy. to supd. the reconstruction of Seringapatam.

Up till April 1805 he had been allowed to retain his post as Engr. & Survr. to the Subsy. Force at Hyderābād, on the grounds that he could still foster the geography of the Deccan whilst in ch. of the Mysore svy.; but now, on the demand of the C-in-C., the post was given to De Havilland [132–3, 393] who was sent up to Berār to take over the duties, and the Council ruled that "in adverting to the pecuniary disappointments which Major Mackenzie has already experienced, and to the inadequate amount of his salary as Superintendent of that survey, comparatively with the difficulty and labour attached to it, [we] cannot in justice...place him in a less favorable situation than that to which he was reduced by the orders of...10th June 1801 [330]. ... It is resolved to continue to him for the present, as a gratuitous allowance, the amount hitherto drawn by him in his capacity of Surveyor of the Subsidiary Force at Hyderābād, amounting to the sum of Pagodas 159-11-65 per month of 30 days"[5].

Mackenzie had been so confident that the Directors would sanction the restoration of his original salary, in which case he would then have to surrender this "gratuitous allowance", that he did not draw it until 1807, when he obtained special sanction to draw it in arrears[6].

He pleaded his case once more to the GG.; "Lord Wm. Bentinck...has taken occasion more than once to mention my case to the Court of Directors; and tho' I must regret that no more immediate remedy could be applied for my relief than the distant prospect offered in the appointment of Surveyor General, ... I am not the less sensible of the attention to my case. I may, however, be permitted still to request the H.E.'s notice of my situation, & whether some temporary compensation may not be found in any appointment of the service suitable to my claims"[7].

On this, Wellesley wrote to Bentinck at Madras; " Your Lordship is fully apprized of my sentiments with regard to Major Colin Mackenzie of your establishment, of my anxious desire to obtain for this active, diligent, and able public officer some substantial reward for his long and useful services. ... Having repeatedly, without any adequate success, recommended those services to the Court of Directors, I am satisfied that the only method of rewarding Major Mackenzie is by some arrangement in this country, which shall place him in a situation proportionate to his long residence in India, & to the successful manner in which he has discharged his laborious duties as a surveyor.

"This arrangement appears to be the more necessary as Maj. Mackenzie has lately lost his Staff situation with the Subsidiary Force at Hyderābād & when the Mysore Survey is completed, will be without any situation excepting his rank in the Corps of Engineers. I am satisfied that both your Lordship & Sir John Craddock[8] entertain a just sense of Major Mackenzie's services, but I am particularly anxious to secure for him a respectable situation under your Government. Major Mackenzie will be entirely satisfied with a Barrack Mastership, & such an appointment will afford him leisure to continue his attention to the improvement of the Geography of the Peninsula.

"Indeed the situation in which he would be most advantageously employed for the public interests would be in the Superintendence & arrangement of all Surveys which may be conducted within the limits of your Government. His long seniority in this Branch of the Service entitles him to such a distinction, but it is possible that such an appointment may be annulled by the Court of Directors, and, as my object is to obtain a provision in this country for Major Mackenzie, the safest mode will be to confer upon him some respectable appointment on his own establishment"[9].

In 1806 Mackenzie declined a suggestion that if the Mysore svy. was sufficiently advanced he might resume ch. of the Deccan svy., writing; 10–9–06 "I have at intervals been employed...at the most healthy & central situations I could select, on the revisal and reduction of the Surveys since the last report; & on much miscellaneous work, ... whilst at the same time the continuation of the Triangles...& their computations, demanded my frequent and close application". There remained also "the heavy work entailed in compilation of Memoirs. ... Since September 1804 particularly...I have been engaged in an unremitted series of personal exertion, ... secluded from any relief of social intercourse, or present Medical Assistance, for 22 months, on the detailed Survey of the Mountainous Tract bordering on the Western Ghaats. ... In this sacrifice of my health & of my professional pretensions...under difficulties only known to those engaged, I looked forward with anxiety to its close. ...

"The resumption at this moment of a further Survey in the Dekan would be immediately attended with the inconvenience of leaving this work short of what was proposed;

[1] DDn. 66, 26–7–01. [2] DDn. 43, 21–10–03. [3] DDn. 66, 26–11–03 & 23–1–04. [4] CD to M. 23–10–05 (94–6). [5] DDn. 68 (101–4), 15–4–05. [6] DDn. 43, 13–7–07 & 68 (131), 18–7–07. [7] DDn. 43, 25–6–05. [8] C-in-C. Madras 1804–7. [9] probably July 1805; BM Addl MS. 13714 (68).

&...at this stage...there would be a risk of losing what formed a considerable part of the original object, without the certainty of attaining the other. ... I therefore request leave... to decline the undertaking the particular Surveys in question ; & indeed, were my health otherwise, I should feel some repugnance in clashing with the propositions of an officer who has so satisfactorily evinced his qualifications for the duty[1]. ...

"I beg leave to submit the expediency of my being permitted to proceed to the Coast with such part of the Establishment as may be necessary to enable me to prepare a General Map of Mysore from this Survey, with a Report, &c.[2]

He was then offered the appt. of Engr. at Seringapatam "provided that his advanced state of the Survey of Mysore shall enable him to undertake the charge without materially interfering with the completion of that work, & that the State of Major Mackenzie's health shall enable him to undertake the proposed reform" ; and this also he declined "as the Survey with which I am engaged is in that state which will require a certain period of tranquility to wind up its results. ... By declining the acceptance of this highly honourable & more advantageous charge, ... I may have the leisure requisite for completing a work on which I consider...my professional pursuits to be in some degree involved"[3].

His refusal of these two appts. resulted in the posting of De Havilland to Seringapatam and the abandonment of the proposed svy. of the Deccan, [134].

Bentinck had to leave Madras without arranging the special appt. which Wellesley had suggested for Mackenzie ; "He considers himself, I know, most hardly used by myself and others. I say not this to his prejudice, but rather for the purpose of making him exactly known. He has at the expence of his constitution, and with the sacrifice of all his own private fortune, prosecuted with the most indefatigable zeal the public work upon which he has been employed. He has attached to his pursuit the greatest importance. ... Worn out in the service he finds himself in poverty. Far advanced in military rank, he perceives his inferiors, who have toiled less, in greater affluence and consideration. There is, I must allow, just cause for those feelings.

"The orders, however, from the Court of Directors have precluded us from giving him the aid which would be well bestowed on him ; the same occasion can never again offer. It has been impossible for me or the Commander-in-Chief to improve his military situation. ... I really do not know how aid can be given to him, unless the Court of Directors, duly appreciating the merits of the individual and the value of his collection, should authorise this Government to indemnify him, ... and to place him in that situation which will enable him to arrange the materials in his possession. Two or three years will probably effect this, and, thus encouraged, I am convinced that he will present...a work most useful towards the perfection of the civil constitution, in the formation of which we are now engaged"[4].

In Oct. 1808, Mackenzie submitted his final maps and reports of Mysore, and, as all expenses connected with the svy. had now to be closed down, Govt. took up the suggestions made by Wellesley and Bentinck that some post should be found that would give him time to arrange his archaeological and historical materials.

Scott and Petrie, both of whom had supported Lambton's work so warmly [265], recorded favourable minutes, Scott writing ; "Major Mackenzie's objects would, I should hope, be sufficiently understood to prevent the little countenance which has been shewn him from being withdrawn ; & when it is considered how little, very little, science we can boast of among us, it is a great pity that those possessed of talents in that way should be checked". Petrie writes ; "Of Major Mackenzie's merits I have never passed an opportunity of recording my sincere respect & esteem ; in labour, assiduity, and zeal, he is inferior to no man. If I had the power, I should place him at the head of an Institution with Liberal endowments for extending & digesting the great & valuable mass of Oriental Antiquities, which at great private expense he has been collecting for a number of years"[5].

Under the recdn. of Sir George Barlow, the new Govr., Mackenzie was appd., MMC. 4–10–08, Barrack Master of Mysore, an appt. which had just become vacant, and which gave him sufficient salary and leisure to remain at the Presdcy., working up his collection and making occasional excursions. At the same time he held ch. of the svy. of the Ceded Dists. that was carried out by the young asst. survrs. most of whom he had trained in Mysore. With the survrs. he sent up his interpreters, who were specially commissioned to hunt out documents and inscriptions of historical interest.

Reference is made elsewhere to his team of collectors, chief of whom were the Brahmans, Boriah and Lakshmiah [355–7]. An account of the great collection of manuscripts and antiquities to which Mackenzie devoted so much of his time and enthusiasm, is left to another volume.

The following note to Ward is typical of Mackenzie's thought for the well-being of his men, and of the maintenance of good relations with the people of the country. "I am as desirous as you can possibly be to have the Canoul[6] District surveyed, but I consider your health at present of more consequence, and am not willing to expose you, through your laudable zeal, to difficulties that I am not unacquainted with. Take your time then ; you have enough to employ you within doors for a little time ; no one can find fault while I approve of what I know well ; and consult and follow Dr. Duncan's advice, and when he thinks your obstructions removed, proceed in God's name in your own way, and I shall be well pleased. I feel myself much obliged by Dr. Duncan's attention to you.

"I have of this date sent you a letter of instructions to proceed when you are thoroughly well. ... I consider it, however, a new scene to you, and entirely unlike Mysore ; the Canoul Nabob is, I believe, a very sensible and high-spirited Mahomedan chief ; but as he has the interior mangement of his own country, you should be careful to avoid giving any offence to their religious or political prejudices. Make it clearly understood that your survey has nothing to do with revenue purposes ; and, as people's followers often excite jealousy by foolish talk, caution yours against any indiscreet conduct"[7].

The appt. of SG. that had been pressed so long was at last sanctioned under the powerful advocacy of Sir George Hewett, who specially named Mackenzie. The appt. was dated 1–12–10, tho' Mackenzie started on his new office very shortly after the orders of 9–10–10 [161–3, 298–9]. He writes to Lambton 19–10–10 ; "When the Commander-in-Chief went

[1] De Havilland [393]. [2] DDn. 43 (191), 10–9–06. [3] DDn. 43 (201–3), 29–11 & 10–12–06. [4] DDn. 68 (382), 8–3–07. [5] Mackenzie bore special resentment against Petrie, for he has left marginal note against this minute ; "A Jesuitical evasion, contradictory of other assertions and promises". Mack MSS. LV, 4–9–08. [6] Kurnool, 57 E, I. [7] DDn. 83, 17–1–10.

away, I had no intimation whatever of what he had recommended, but from the tenor of a note from Col. Conway[1] I was induced to think that he was so far favourably disposed to my own pretensions, that I should not be annoyed in future by such letters as I had lately complained of; which was in fact all I wanted at the time; the Governor also intimated the same point.

"But after he [Hewett] sailed, we had at first reports that the long-talked-of Commissariat was to take place; and that it was also to embrace the Barrack Department. However, I gave no credit to it till the 11th, when I was assured from good authority that it was out, and the G.O. appeared the same day. On Tuesday 13th, I waited on Sir George Barlow, and observed to him that I was once more adrift by the termination of my appointment[2] on the 1st Dec. next. He replied that it had been granted on public grounds, and now it was resolved to give me the appointment of Surveyor General, a situation that had long been recommended for me—in fact so early as 1798. Little other passed—I conceived it unnecessary to enquire into particulars, as I presume it had been determined some time, for I now find several say they had heard of it, though I had not.

"I think he mentioned the Q.M.G.'s office was to be relieved from the charge of surveys, but in what manner their duties are to be hereafter conducted I have not the least idea of [321–2].

"The situation itself was desirable enough to me 12 years ago, and ever since; but I must confess I enjoyed a certain degree of tranquility that I shall regret to be back in office, though I hope it may not be so, and that I may be still of some use if I can be any way instrumental in bringing these intended works to be carried on, on one uniform system [8, 161, 302–3]. The loss of my late appointment after 27 years Indian service, and only holding it for two years, is also serious, but where it cannot be helped, and so many suffer, patience is a virtue, since I could not expect to be excepted.

"The moment I hear anything regarding you, I will write you; but I go out so little that it is probable you may hear long before I do what is likely to take place. I cannot help thinking that the extension of your work would be supported by the Commander-in-Chief in India [Hewett]. I am not yet certain whether I may not be obliged to go up to Mysore by Dec. 1st. You are right in your motive for being near the Presidency to get the thing effected, if it were only to save time. I imagine Col. Agnew must have just ideas of the value of these works; he was observing to me lately that at home, now, they appear to appreciate them more accurately; this was in regard to the late orders from home regarding my reduction in 1801, on which I have yet got no official communication [422]"[3].

News reached him a few days later that, on receiving the final maps and reports of the Mysore Svy., the Directors had relented on the matter of allces., and had made practical amends; "Finding his representations...of the inadequancy of his allowances are seconded by very strong recommendations from you, we direct that you present him with...9,000 pagodas as full remuneration for his past Labours, and as a mark of our approbation"[4].

The first tasks of the new SG. were to analyse all the svys. in progress, obtain orders as to their continuance, and to work out an est. for his new dept. [161–3]. An acute controversy arose between him and Valentine Blacker as to the extent to which the QMG. should retain responsibility for mil. svys. Mackenzie was insistent that the SG. should have the fullest control, and that no geographical information or material should be kept from his cognizance, and Govt. decided in his favour [276, 291, 301].

Before this reorganisation was completed, he was appd. CE. to the Madras force proceeding to Java [3, 135, 299]. His appt. dated from 12–3–11, but he did not embark till the end of April.

He writes to Lambton, 29–3–11, "All my preparations for the expedition are closed, and I am ready to embark at very short warning. Of the time of our sailing I can give no certain idea, but from report we are told that they will sail after the junction of the Bombay and Goa transports; the latter have the 78th regiment on Board [I, 349]. Lord Minto on 9th left Calcutta, and may be hourly expected here, but he is not to make any stay. I supposed you would be surprized to hear of his going with us to Java; there are various opinions as to the season of sailing, and in general the Naval people think it late, and that our passage will be obstructed from the straits of Malacca by easterly winds and currents for several months, while others think the delay of waiting for many months till the next change of season would be worse than the former inconvenience.

"As for myself I have nothing to say, but to be ready, while I avail myself of every day's delay here in bringing the Surveying establishment to an uniform system"[5].

On joining up with the Bengal troops at Malacca[6], Mackenzie was appt. to comd. all the Engrs. of the expn., and was deputed to reconnoitre the Java coast in advance, and choose a spot for the landing. We find reports which he had collected at Madras and Malacca regarding "the state of Batavia and...the Island of Java", and "of the Fortresses, Roads, & Landing Places", and also the secret instructions given him on June 6th[7]. He embarked 6–6–11, and reached the coast of Java on 13th July, accd. by Blakiston who gives a thrilling account of their adventures [383];

"Colonel Mackenzie and I having shifted our Quarters to the Leda, the M— & B— ships proceeded in quest of the expedition. From this period to the end of the month we employed ourselves in exploring the Indermaya R. up which we rowed a considerable distance without meeting any interruption. ...

"Left ship 14th, with 4 boats with 30 of marines & 69th Regt. for purpose of reconnoitring the Coast to the E. of Tanjong Priok. In order that we might not excite any particular notice while on shore, Col. Mackenzie and I dressed ourselves as seamen. When thus equipped for our expedition the Colonel, who stood 6 ft. 2 inches, cut a most ludicrous figure in a jacket and trousers belonging to the Captain, which reached about half way down his long Lismabago limbs[8]. ... Anything but a laughing business. ... Lulled into security...reconnoitre to village. ... We were on the point of entering the street when I observed a large cocked hat make its appearance from behind a corner. ... A French or Dutch officer sallied forth, followed by a large party of soldiers. Having only 4 men with us at the time and being ourselves unarmed, ... we took to our heels, closely followed by the enemy, who fired smartly at us. Fortunately we took the nearest road down the avenue leading to the spot where we had left the boats.

"As the enemy were close upon us, and as Col. Mackenzie was an old man, and might be in possession of papers which would show the object of our Landing, the first idea that occurred to me was to rifle his pockets and leave him to his fate, never supposing that he could escape from our younger

[1] AG. Madras from 1809. [2] Bkmr., Mysore. [3] DDn. 83, 19-10–10. [4] CD to M. 9–2–10. [5] DDn. 66. [6] 120 m. NW. of Singapore. [7] Mack MSS. XIV. [8] Spanish expression? Blakiston served in Peninsula War, 1813–4.

and, as I supposed, more nimble pursuers. But when I observed him taking at least 3 yards at a stride, I saw that, however ill-disposed he might be on ordinary occasions to fly from an enemy, nature had amply provided him with the means when necessary; in fact, that the agility of his heels was fully equal to the strength of his heart. ...

"We retreated with precipitation to the boats. ... The officer of marines with the party of 69th were to the flank, their retreat cut off, and were made prisoners. ... In reaching the Boats, the Colonel's height was again of considerable use to him; for while I was obliged to swim some distance, he strode along, like Gulliver among the Lilliputian Fleet. ...

"An obvious ambuscade, and if the officer who commanded...the enemy had allowed us to advance into the heart of the village, they would have succeeded in capturing Col. Mackenzie and me"[1].

On arrival of the fleet, Mackenzie guided the army to land at that same village, Chillingchilling, and Batavia, 12 m. to the W., was captured 26–8–11.

On the departure of the GG. and the main army two months later, Mackenzie was left in Java with the primary purpose of making a geographical and statistical report for the Supreme Govt., the GG. writing, 10–10–11; "It being the wish of Government to collect all the Maps, Charts, or Plans, of the late French Government relating to this Island, ... you will send to the public offices...any that may be in your possession, and...furnish me with any information in your power respecting Documents of this Description in any other part of the Island". With his usual thoroughness Mackenzie submitted a lengthy memorandum on the work to be done, and the GG. approved, 18–10–11, "the measures you propose taking...towards the elucidation of the Hydrography and Geography of the Country, ... extended to Memoirs connected with the Military Defence and History of the Country".

"A Commission...is appointed to collect and Register...all public Archives, Records, Plans, Surveys, or other public Documents of the former Government in the hands of the different Departments. ... Col. Mackenzie...is required to give his assistance to the Commission for the arrangement of the ...records so collected"[2]. He was further appd. presdt. of a committee to assist in working out plans for revenue admn. that "should consider the Inhabitants without reference to bare Mercantile profit, and...connect the sources of the Revenue with the general prosperity of the Colony"[3].

With two Dutch officials as fellow members, the com. was given the following instns.;

"To obtain an exact Knowledge of the tenure upon which the Lands in Java are at present held and cultivated, ... and what are the Services due by the people to their Chiefs? ...

"What in each District is the extent and proportion of Cultivated Lands...in possession of the Regent and his Relations?

"On what tenure and on what conditions do they give them out to others to be cultivated? ...

"What share of the Crops...is allotted to the actual Cultivators? ...

"What is the proportion of uncultivated ground in each District...still proper for the cultivation of Rice, and where situated?[4]

In addition to these main duties Mackenzie's services were "always considered available to the Government, and in many instances his professional advice and Assistance were required; he was also employed in the assault of Jokyakarta the only Military operation of any importance...which occurred during his residence"[5]. He was still a soldier; "The Major General considered you detained professionally and in a Military capacity, in as far as he was enabled at all times to avail himself of your Services, and which, in the unsettled state of the Colony, ... he regarded as an object of consequence. Engaged as you were in pursuits of such importance to the General interests of the Colony, he was reluctant in ordinary times to withdraw your attention to the minor details of the Engineer Department, but, had other occasions of particular emergency arisen as was actually the case in the instance of the Djocjocarta war, he would not have omitted in the same manner to claim the assistance of your professional talents and exertions[6].

"The Committee for examining the Tenure of Lands" completed their labours early in 1813, and was dissolved at the end of Feb., and Mackenzie released in July to make his reports in person at Calcutta. On his departure the Lt Govr., Stamford Raffles, issued the following appreciation; "Lieutenant Colonel Mackenzie has, since the conquest of Java, been employed...in collecting and arranging the topographical and Military Reports and Surveys of the former Government; in investigating the History and Antiquities of the Island; and in ascertaining the state of the landed tenure and the general condition of the Inhabitants.

"The topographical surveys commenced under the late Government have been found to merit every attention, and...they will be continued partly on the same plan. On the History and Antiquities of the Island much valuable information has been obtained. ... As President of the Commission on Java Affairs, Lieutenant Colonel Mackenzie has visited almost every part of the Island, and the considerable and important Collections which have been procured by his personal diligence and research will form a body of most useful and interesting information, to serve as a *Basis* for the...statistical enquiries which have been set on foot. ...

"Java must ever be considered as a great agricultural Country, and as the Granary of the Eastern Islands. To remove every restriction on the agriculture and Commerce of the Country is alike conducive to the happiness of the people and to the interests of Government, and the information and opinions furnished by Lieutenant Colonel Mackenzie will enable Government...to establish a more enlightened and advantageous system of internal administration"[7].

In a lecture to the Batavian Society of Arts & Sciences, of which Mackenzie was a member, Raffles said, 24–4–13, "The collections of Col. Mackenzie...prove the zeal with which he has taken up the subject; and on his return to India, where an opportunity may be afforded of decyphering several inscriptions found in different parts of Java, of which he has taken facsimiles, we are promised that his exertions will not be relaxed in endeavouring to illustrate whatever may be important"[8].

[1] Blakiston II (10–7; 15–9); cf. Mack MSS. XIV (57–89); *Conquest of Java*, (15 *et seq*); Vibart (454). [2] These instns. 22–10–11 largely explain the attitude of Raffles towards mil. svys. [135–7, 293–4]. [3] BMC. 12–1–16 (96). [4] J Cor. 21–1–12. [5] From Java Govt. 7–2–15. [6] From Wm. Colebrooke, late MS. to Comdr. of Forces, Java, 1–12–14; BMC. 12–1–16 (96) [7] GO. Batavia, 15–7–13; MMC. 17–9–13 also *Java Govt. Gaz.* 17–7–13; *CG.* 2–9–13. [8] Stamford Raffles (139); cf. *AS J.* II; *CG.* 11–2–13.

Mackenzie sailed from Batavia, 16–7–13, in the *Isabella*, accd. by his Dutch wife, and her sister [419]; they reached the mouth of the Hooghly 17–8–13, a full month's journey[1]. By request of the Supreme Govt. he was allowed to remain in Bengal to arrange his collections and finish his reports. He completed the first report 10–11–13, under the title *General view of the results of Investigations into Geography, History, Antiquities, and Literature, in the Island of Java, ... in the years 1811, 12, and 1813.* Many of the original papers from which this report was compiled are still preserved at the IO. The report refers to "complete registers...taken of the numerous atlases, plans, charts, and memoirs, belonging to the Dutch Government since its establishment from 1612 till the year 1811". Final reports were submitted 18–2–15[2].

With the preliminary report, Mackenzie asked permission, 14–12–13, to remain in Bengal "for such reasonable time as may be necessary for completing a General View of the State of that Island"[3]. Two weeks later he writes from Hazāribāgh, Dec. 26th; "Conceiving a further extension of the period for my completing certain reports on the Island of Java would be necessary, ... and it being desirable for me for motives of private business, and on account of my health, to make a journey to the Upper Provinces during the cold season, ... I presume to hope the sanction...may be rather extended...from a consideration that, in the whole course of a service of 30 years, I do not recollect having ever solicited for leave of absence from my duties for Private motives before; and as this Journey furnishes an opportunity of visiting the Frontier Provinces that may not come within my reach again, this indulgence may be considered scarcely inapplicable"[4].

Leave was granted up to Sept. 1814, and he writes from Agra, Feb. 20th, writing that "I was obliged to leave Calcutta on the 14th December in considerable haste, in order to accompany the Party I was to travel with to the Upper Provinces". The chief member of this "party" was Lady Hood, wife of the admiral, and in March 1814 Mackenzie, Lady Hood, and Ezekiel Barton [83, 380–1], joined Hodgson in the Dūn for a few weeks. Plans for svy. of the Himālaya districts were discussed, and Mackenzie describes with enthusiasm his first view of the Snowy peaks [88–9, 408]. He separated from Lady Hood's party for a few weeks to visit Kālinjar in Bundelkhand, rejoining her, July 2nd., at Benares to escort her down to Calcutta by boat, where they arrd. in Sept.; Mackenzie's name appears amongst signatures to an address presented to the GG. "by British inhabitants at Patna", 12–8–14[5].

Whilst up country he writes to Crawford, 7–7–14; "A short excursion I made into Bundelcund...induced a wish to be better acquainted with that tract of Table Land that extends...into the Dekan; at the Presidency I shall hope for an opportunity for applying to you for some information of the Geography of that region which, according to the Hindoo myth, be called Goondwana". Again from Buxar, 17–7–14; "For some time since I have been on the journey, I have been desirous of communicating with you on several points connected with our mutual desire, I believe, of improving the general knowledge of Indian Geography, but as my journey was so rapid at times, & interrupted at others[6], I was wholly prevented. ... In a few days hence I hope to be at Patna, when I will be able to ascertain the precise term of my probable arrival at Calcutta[7].

In a later letter he claims that this visit to work actually in progress in the Upper Provinces would be of great value in his conduct of svys. in Madras [302]. In his summary of travels he writes; "Afterwards on a journey to Calcutta by Benares to Lucknow, Agra, & Delhi, to the mountains dividing Thibet, whence the Jumna & Ganges issue into Hindustan, back from Hurdwar on the Ganges through Rohilkund, and again to the Ganges. On this journey of 9 months, the same method was observed of preserving notes, Memoranda, memoirs, and journals, and the collection of ancient coins, manuscripts, and inscriptions, sculptures, considerably increased [107, 111, 135, 153, 355–7]"[8].

He refers to these travels in a letter to Lambton two years later; "While I was in Java & in Hindoostan, I frequently had it in view to write you, but in the whole of that long period of 4 years I never was three months without some view of returning, & consequently considered it unnecessary to write. ... The voyages & Journeys through Java were highly interesting; it was quite a New World, & in Hindoostan equally so; the rapid but extensive Journey as far as Delhi & Hurdwar will ever be remembered by me[9]".

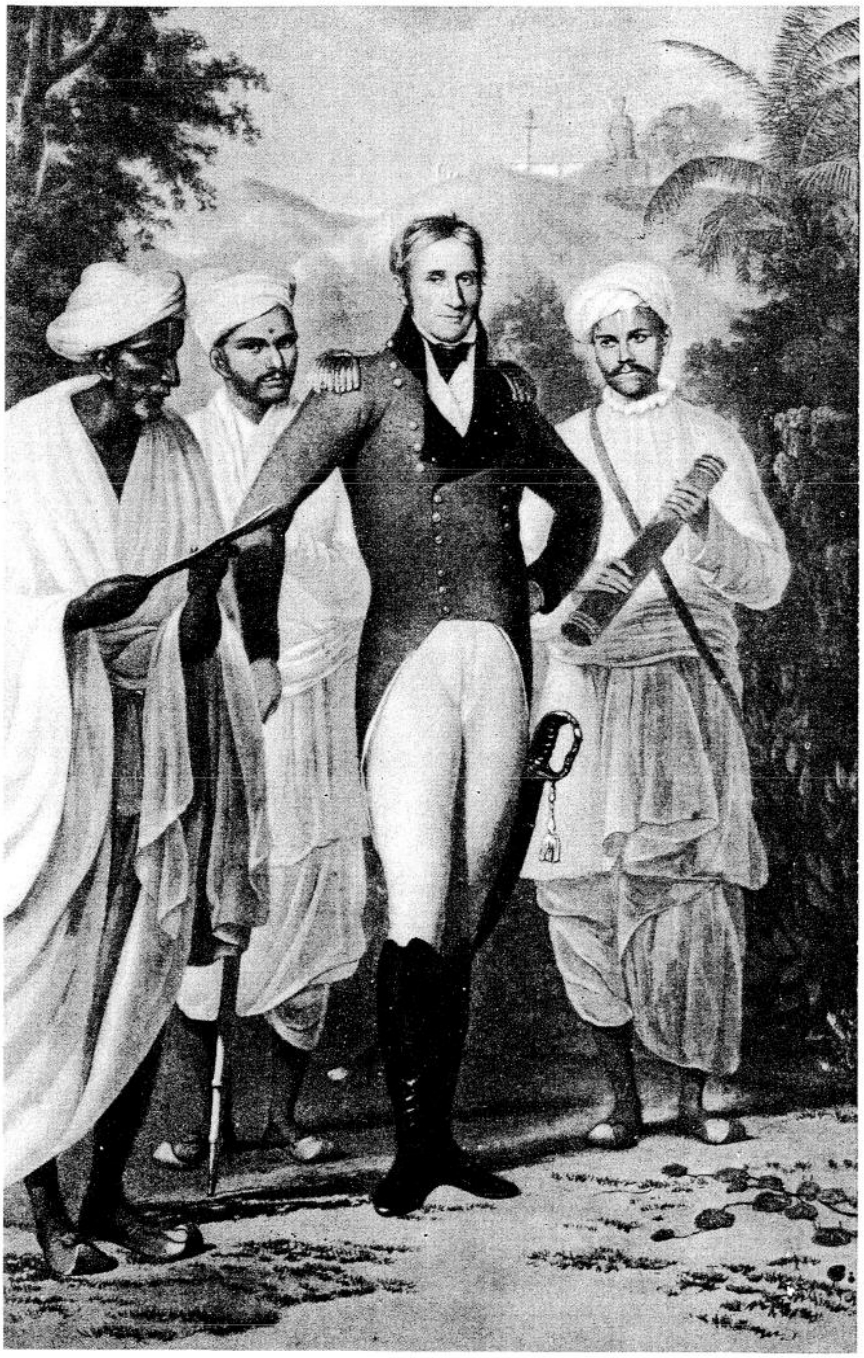
As Lady Hood (*DNB.*) claimed to be a relative [83 n.8], and was a very remarkable woman, it is worth telling something of her She was Maria Elizabeth Frederica,[10] (1783–1862), eldest dau. of Col. Francis Humberstone Mackenzie, 78th Foot, younger bro. of Thomas Frederick Mackenzie Humberstone [I, 99 n.1]. Her father was cr., 26–10–1797, Lord Seaforth, Baron Mackenzie of Kintail. On his death, 11–1–15, having outlived all his male issue, the family estates passed to his eldest dau., who had, 6–11–04, m. Adm. Sir Samuel Hood, 1st Bart [*DNB.*], who was, 1813–4, comdg. the fleet in E. Indies.

Lord Moira had met the admiral and his lady at Madras, and records that on his way out in 1813, "17th Sept.—Dinner awaited us at the admiral's. It is rare that a magnificent entertainment is a pleasant one, but Sir Samuel and Lady Hood had the talent to make this so. After the dinner there was a ball, at which we stayed to a very late hour"[11]. It is not surprising that Lady Hood had no difficulty in obtaining the GG.'s approval to her expn. up country, and it was most probably thro' his influence that she obtained the escort of Mackenzie, who was obviously delighted at this opportunity of seeing Upper India, tho' we have no record of what he thought of leaving his wife in Calcutta, and travelling with Lady Hood instead.

Hodgson makes frequent references to her talent for water-colour painting, and her influence with Lord Moira [408]. He was called on to escort her as far as Benares on the return journey, Lady Hood writing from Cawnpore, July 4th, that she "intended setting out for Calcutta a few days afterwards. Col. Mackenzie had gone into Bundelcund for the purpose of visiting Callingar"[12].

On the Admiral's death at Madras[13], 24–12–14, "without issue", Lady Hood returned on his ship to England, and m., 2nd, 1817, James Alexander Stewart, of Glasserton. Lord Teignmouth tells of visiting her many years later; she "resided at Seaforth Lodge in Stornaway. ... Mrs. Stewart Mackenzie is no ordinary person. ... Circumstances afford full play to her peculiar talents and graces of manner and deportment; whether accompanying her father during his government of Jamaica, or as wife of Admiral Sir Samuel Hood when commanding on the Indian Station. ... An amusing anecdote was circulated of her having travelled in India some hundred miles for the express purpose of amusing the

[1] *CG. Suppt.* 26–8–13. [2] *EIMC.* III (321); Blagden (xiii–xxvii). [3] MPC. 31–5–14. [4] ib. 22–4–14. [5] *CG.* 21–8–14. [6] by Lady Hood? [7] DDn. 136. [8] DDn. 195 (13) & *JRAS.* I. 1834. [9] DDn. 156 (35–6), 3–5–16. [10] *DNB.*, elsewhere named as Mary Frederica Elizabeth. [11] Hastings' *Journal* (13). [12] *CG.* 21–7–14. [13] MI. St. Mary's ch. Ft. St. George.



COLIN MACKENZIE (1754-1821)

MADRAS ENGINEERS, C.B., F.R.S. THE FIRST SURVEYOR GENERAL, MADRAS, 1810–15, AND FIRST SURVEYOR GENERAL OF INDIA, 1815–21.

FROM ORIGINAL OIL PAINTING AT INDIA OFFICE, BY THOMAS HICKEY, 1816 (PTO).

30°

90°

NOTE, Plate 22

A note written on the back of the frame of the original, that was presented to India House by Henry Traill in 1822 [419 n.6], states that the picture shows

portraits...of three distinguished Brahmans of the three leading sects in the south of India. The native holding the telescope is Kavelli Venkata Lakshmerjah [356], President of the Literary Society of Hindus in connection with the Royal Asiatic Society of London. In the background is represented the celebrated colossal figure of Buddha [235].

Sir William Foster, of the India Office, adds that,

of the two Indians other than the one named, the figure on the right is a Jain priest who was for long Mackenzie's assistant [356], while that on the left is his old peon Krishnaji [vol. III].

The background consists of trees and rising ground, on which is seen the...monolithic Jain statue, 60 feet high, of Gomateswara at Shravan-belgola in Mysore, the exact dimensions of which Mackenzie was the first to determine[1].

The original authorities for these identifications are not known, but neither Mackenzie nor Lackshmaiah whose evidence would have been infallible are likely to have described the Jain statue as representing Buddha. Lackshmaiah was certainly not President of the Hindu society so early as 1822.

Certain doubts were referred during 1948 to three leading Indian authorities, including Dewan Bahadur Professor C. S. Srinivasachari, M.A.[2], and the following deductions appear reasonable, though by no means conclusive.

The figure on Mackenzie's left, bearing telescope, and with sling over shoulder, has the three-pronged mark of the *Vashnawas*, and is more likely to be the peon, Kistnaji, entrusted with the humble duty of carrying instruments.

The figure immediately to Mackenzie's right, and behind, has the caste mark of a Telegu Smartha Brahman, is an obvious *pandit*, and the most likely to be Kavali Venkata Lakshmaiah, of a Telinga family who in 1816 was still a young man. The wearing of a *kamarband* was common amongst middle and upper classes of those days, and whiskers not taboo.

The elderly figure on Mackenzie's extreme right is also a *pandit*, and, moreover, carries a palm-leaf manuscript. From his dress and appearance he may well be Dhurmia, whom Mackenzie refers to as "the poor old Jain" [vol. III][3].

On the nearer hill in the background, presumably intended for Chandragiri, is the familiar pole-and-basket survey signal, and beyond that is the Jain statue, thus described by Percy Brown ;

Some forty miles north of Mysore city is the sacred site of Sravana Belgola. ... As early as 309 B.C. a community of fugitive Jains settled here. ... Connecting the Chandragiri hill with that of Indrabetta is the Pilgrims' way, which, passing...the holy tank of Belgola, ascends...by innumerable steps...to the walled enclosure encircling the summit of Indrabetta. ... On the Indrabetta hill, depicting Gommata, son of the first of the twenty-four Tirthankars, ... this gigantic image stands over fifty-six feet high...and was carved in situ. ... Entirely nude[4].

[1] Foster (7). [2] Principal of Rajah Doraisingam Memorial College, Sivaganga. [3] These deductions are not a quotation. [4] Percy Brown (161–2); photo of statue *Wonderful India* (460).

celibate, ... the stiff, but estimable, Colonel Mackenzie, ... on the precise score of his known disinclination to female society"[1].

No evidence has been found of relationship between Mackenzie and the Seaforth family as claimed by Lady Hood, and it was possibly no closer than the traditional clanship between Highlanders, that would be ample for claiming an escort.

Mackenzie writes to a friend, 23–12–17, "Lady Hood Mackenzie writes us in April that she was to be married in May to the Honble. Mr. Stewart, a brother of Lord Galloway's but we have not heard that it had actually taken place. ... Your letter, I take it, ... is after that happy event, which gives us great joy"[2].

On return to Calcutta, Mackenzie applied for a further extension of leave from Ft. St. George, on account of "the lateness of my arrival at this Presidency, which had also been longer protracted by the necessity of remaining at one of the upper stations [Patna] to lay some explanations before His Excellency the Governor General of my claims to the allowances under which I was originally sent on the expedition to Java"[3].

He explained that he was still detained in Bengal by the translation of various Dutch documents brought from Java, which was being done at Chinsura. "These Reports and Materials on the state of Java, derived from the Commission I was employed on, were originally ordered for the information of the Governor General. ... This part was considered entirely distinct from my Military duties on which I have transmitted reports to His Excellency the Commander-in-Chief at Madras, and to Sir Samuel Auchmuty in June 1813". He also had in hand "several documents of import connected with the Geography of the Oriental Islands, as well as a variety of observations and documents on the Military Defence of Java. ... It was my intention, having now obtained the rough translations...to...draw up such a sketch view of the whole as the time...may admit of, ... till the change of monsoon admits of my proceeding to the Coast of Coromandel, either by sea or land". He further reports that he had working for him in Bengal "my Establishment from Madras" [352] and "an occasional Establishment of people here and at Chinsura—Translators, Writers, and Draftsmen, and some from Java"[4]. He had brought with him "an ingenious native of Java", who had been his translator since 1–11–11.

During his stay at Calcutta he saw much of Crawford, obtaining sanction to examine the maps in the SGO., and take copies of Bengal svy. rules [302–3]. After handing in his reports, "the last part being only dispatched from Sāgar, from the necessity of reserving them to the last moment for the necessary corrections", he sailed "in the ship Flinders" reaching Madras, 30–3–15. "I chose on this occasion to proceed by Sea in preference to a land journey for greater expedition, in a vessel so very much crowded that room could not be procured for the most useful part of the Establishment that had originally accompanied me on the service to Java; the passage, usually made in 8 days, was prolonged from 21st February to the 30th Instant by southerly winds and adverse currents uncommon in the Bay at this Season[5] [I, 303]".

The following advts. show that Mrs. Mackenzie had been living comfortably during his travels;

"Sale by Auction. The following Elegant Palankeen Carriages, the property of Colonel Mackenzie, leaving Calcutta; A very Elegant roomy Palankeen Carriage for 4 persons, ... built to particular order; one of the best carriages of its kind in Calcutta.

"Auction. Sale of property belonging to Lt. Colonel Colin Mackenzie; leaving Calcutta.

"Household & Table furniture; plate, wines & liquors"[6].

On arrival at Madras, Mackenzie at once resumed the reorganization of the survey dept. that had been interrupted four years earlier [336–7], and, under BGO. 1–5–15, was appd. Surveyor General of India [306–7].

We have referred to the persistance with which he pressed claims for allces. that he considered his due [421–2]. In 1800 he successfully pressed for payment of "Colombo prize money, ... for the advanced class superior to my rank at the time; as Principal Engineer on that Expedition" [I, 350]. In 1808 he pressed similar claims for Seringapatam prize money at the scale due to a Lt Colonel, tho' he had only been Captain at the time of the siege[7].

The order apptg. him CE. to the expn., 12–2–11, was made "without prejudice to his appointment as Surveyor General", and authorised him "to draw consolidated allowance of Pagodas 250 p.m. in lieu of all charges for Establishment; together with the difference between Major & Lt.Colonel's full Batta"[8]. His rank at the time was Major & Bt.Lt. Colonel.

As he drew allces. as SG. for the whole period he was absent from Madras, he was unwilling to draw that sanctioned for the Committee of Land Tenures. "The amount of this has been regularly drawn by the other Members, but some hesitation has been felt on the part of Lt.Col.Mackenzie, ... under the assurance that he offered to Your Lordship [the GG.] previous to your departure, that his stay in Java would not occasion any additional expense to Government. Colonel Mackenzie has in consequence only received a part of this allowance...to defray some absolutely necessary expenses"[9].

After long corr. he succeeded in drawing CE.'s allce. from 30–9–11, when the main army was withdrawn, right up to the date of his return to Madras. He required this to meet the pay of the staff he had taken from Madras and employed on official work in Java and Bengal.

He had to fight for tent allce., and even for table money on his passage by sea, all on the point as to whether he was on mil. duty or not; decision in his favour was not made till 1816, and the arrears that were then paid to him amounted to Rs. 17,026-7-10[10].

He met particular trouble over his claim to draw allces. of Brigadier for the period he was senr. officer of Engrs. on the expn., which he based on a GO. issued by Lord Cornwallis at Bangalore, 20–11–1791. He was still pressing his claims in Calcutta at the end of 1818, and had some idea that their hold-up was due to his patron Stamford Raffles having fallen out of favour. He writes privately to the Ch. Sec., 3–12–18;

"I called last week, but not being in luck to find you at home, I...put you in mind that I have certain claims for allowances due to my situation, also for expenses incurred, and 3rd, for compensation of my time and labour, both in Java and in India, ... which it were desirable to adjust at last, on the same scale that others have been settled. ... The last measure I took at Madras was to send in a memorial thro' the Commander-in-Chief in July 1817, which I understand he sent in directly with a letter, ... and no notice has been ever taken of it since. ... I am willing that my claims should not be considered in any way belonging to Sir Thos. Raffles' affairs. All the testimony that was required from his Government has been long since furnished; ... but I am desirous that on a proper occasion my pretensions should be enquired into, and not looked over. ... Be so good, frankly and kindly, to let me know when I may see you on this; next week I think it best"[11].

[1] *Reminiscences* (350). [2] DDn. 156 (313). [3] Ft. William, 28–9–14; MMC. 13–12–14. [4] ib. 13–12–14. [5] Letter of 31–3–15; MMC. 15–4–15. [6] *CG.* 8–12–14 & 23–2–15. [7] MMC. 26–4–08. [8] MGO. 12–3–11. [9] Java to Bengal 15–7–13; MMC. 17–9–13. [10] BMC. 12–1–16 (97). [11] DDn. 154 (51), 3–12–18.

There is no doubt that the unsettled state of allce. regns. of those days led to great loss of efficiency and time.

The story of Mackenzie's work as SG. of India will be told in another volume.

MACLEOD, John. Bo. Engrs. bapt. 8–7–1794. d. 20–9–23, Bushire.

Ens. 25–10–11 ; Lieut. 26–1–19.

Son of Rev. Roderick Macleod, DD., Principal of King's Coll. Aberdeen, and Isabella Christie, his wife.

30–3–10, MA., Aberdeen ; 1811–2, remained in England as cadet, on course of svy. [308–9].

1813, Bombay, employed as dmn. with rev. svy., drawing additional Rs. 2/- a day from 6–7–13 for "most active share in all our practical operations, as well in the Fort as at Colaba and other parts of the Island"[1]. Continued as asst. on rev. svy. [187, 323].

MI. in Armenian ch., Bushire.

MacMURDO,[2] James. Bo. Inf. b. 30–11–1785. d. 28–4–20, near "Arrasseer"[3].

Ens. 22–5–01 ... Capt. 1–11–17.

Son of Jas. Pringle MacMurdo of Rowland, Selkirk.

1809, comdg. escort with Resdt. at Baroda ; deputed on mission to Hyderābād, Sind, across the desert and, though failing to get beyond the Pālanpur border, brought back a valuable route sketch [169–70, 173].

1815–6, AGG. in Kathiawar ; 1816–20, Resdt. in Cutch.

Auth. of *Observations on the Sindhoo, or River Indus :* "The Indus is called in the Sanscrit writings Sindhoo or Syndhoo, which is undoubtedly the original name. Mehran and Meetha Mehrannur are the names by which the Indus is most commonly known in India" [I, pl. 4 n.][4].

MACPHERSON, Evan. Mad. Inf. b. 4–2–1785. d. 22–1–47.

Ens. 3–7–07 ... Maj. 25–6–36 ; ret. 10–1–37.

Son of Lachlan Macpherson, laird of Ralia.

m. Helen, dau. of Capt. George Birrell, (d. 1830 ?) Ben. Inf. (Hodson).

March 1810, MMI., cl. V, [321].

1812, employed under QMG., on svy. of routes of Dowse's force, in S. Marātha country [166].

Well thought of by Mackenzie, who writes, 26–11–19 ; "The objection...as to drawing I do not consider very material, provided he is correct and able to control the labors of others. ... I had a great regard for some friends of his, ... but that would not influence me if he were not competent to the undertaking". Again, 9–2–20 ; "I am sorry Mr. Macpherson was not employed in Rajahmundry, as his local knowledge and seasoning to the hills would have been avail [*sic*]".

From 1815 suffered from malignant fever picked up in Ganjam, recurring in Madras, Dec. 1819, and Coimbatore Feb. 1820. From 1820 employed with Pioneers in Nīlgiri Hills, where he soon recovered health [148–9].

MRC. 21–7–20 ; "employed in making a road up the Neelgherry hills" ; appd. to "survey Country on their Summit". Produced no svy. of value and, "after building his road, ... contrived to remain for several years on the hills, where he acquired considerable property, and built many houses. In 1825 and 1826 he was certainly residing in Ootacamund, and [with] two other officers, ... made themselves so notorious for their misdeeds in the house-jobbing line, as to evoke the special reprobation of the Governor"[5].

MATHER, John [I, 354–5]. Civ. Survr. ; drowned, March 1808, off coast of England.

Son of Robert Mather, of the Mill at Newburgh, and of Gight, nr. Fyvie, Aberdeen.

MA., Marischal Coll., Aberdeen, 1780.

1794–8, on svy. of Bāramahāl [I, 113–4].

4–9–1799, appd. Asst. on svy. of Mysore [91] and, 8–2–1800, left Madras, having been delayed by sickness [93, 94] ; completed svy. of Hosur dist. before end of June, and then granted leave "to the coast, a measure which the ill state of his health renders necessary during the rains" [94–8, 117–9, 204–5, 207–10, 212][6].

Mackenzie had great regard for his professional advice, consulting him frequently, and showing him consideration in every way [112, 156, 231, 236, 343–4][7]. He writes to the Resdt., 26–5–01, regarding "Mr. Mather's health, ... being subject to Rheumatic complaints which are apt to return in cold damp situations". To Arthur, 12–7–01 ; "If you fall in with Mr. Mather, explain my sentiments regarding him, which you are well informed of. I could wish you to show him every civility consistent with his station, for his industry and correct behaviour claim the exercise of every decency in our intercourse. I believe his good sense will not induce him to soar beyond it" [99–101].

He writes to Warren, 27–11–01, commenting on the cut in allces. [330–1] ; "I am glad your interview with Mr. Mather was so satisfactory ; he, poor fellow, is most to be pitied, having no other livelihood, while we, as they kindly say, have our pay and allowances in the service also to look to". As it turned out, the cut ordered in Mather's pay came only to a few *fanams* a month.

In 1802, Mather was again allowed down to the coast for the rains [101, 102], Mackenzie writing, 4–7–02, I am much concerned to find your former complaint torment you so much, and I cannot help feeling some uneasiness lest your perseverance and application in this season throw you back. I can see no objection to your coming to the coast when the district you have in hand is completed, ... indeed without waiting to complete it if your state of health renders it necessary"[8].

After Mather's return from a particularly exhausting svy. over the Ghāts to the W. coast, he was met by a welcome present from Mackenzie ; "I requested Mr. Franks[9] a few days ago to send you...two cooly loads of wine and refreshment, which I request you to accept from me as a small token of my satisfaction with your zeal and industry. It will give me pleasure if it arrives in time to be of any use in rendering you more comfortable after your late fatigues" [104–7, 420–1][10].

Mather continued to press for some increase of pay, and promise of future pension [I, 355] ; "When I adopted surveying as the pursuit of my life, I certainly looked up to it to shield me from the fear of want at some future period, when age or infirmity might render it necessary to retire ; but which...my present salary...affords but a very distant prospect of ever seeing realized. I have now persevered in this arduous and unhealthy pursuit 8 years, surveyed nearly 10,000 sq. miles, and suffered very severely in my constitution"[11].

He was warmly supported by Mackenzie, 23–11–02 ; "He has now for upwards of seven years acted with approbation

[1] Bo Rev. C 20–2–14. [2] Sometimes McMurdo. [3] possibly Ardysir, 41 I/14. [4] *Bo Geo Soc.* III, IV, V (124). [5] Price (149). [6] DDn. 44. M 132 contains Journal in Mather's writing with autographs. [7] It is sad that a volume containing Mather's letters to Mackenzie 1799 to 1803, was amongst those lost before 1930. [8] DDn. 66. [9] Anthony Franck, shopkeeper ; James F. merch. ; A. F. F. auctioneers, Madras, from 1799 (Cotton). [10] DDn. 66, 9–5–04. [11] DDn. 41, 11–11–02.

in this line, and since he was employed in Mysore has from the nature of the service been more particularly subject to the increased inconvenience of frequent privation of the comforts and aids derived at our stations, and to long and expensive journeys in consequence of duty or impaired health, without the prospect of gradual rise of rank or pay, on a salary of only 50 Pagodas a month" [361].

Govt. now added to his salary the allces. of a Surveyor [something over 11 *ps.* a month] from the date of first appt. to the Mysore svy., and asked the Directors that "in the event of his losing his Health by a close attendance to the duties of a Surveyor, the Governor in Council may be authorized to grant him an adequate Pension for life"[1], and in their letter of 27–5–04 (36) the Directors authorized "a pension not exceeding one hundred pounds per annum in the event of his being obliged to quit his surveying pursuits".

After two seasons in the jungles of S. Kanara [108–10], Mather decided that he could carry on no longer ; "Owing to the heavy rains in the low country, the having my carts and baggage to transport across a country almost under water, the want of boats to cross the river, and, above all, the sickly state of my people, I was prevented from reaching this place[2] till yesterday. ... I have travelled the whole way in the rain, which has operated much to my disadvantage ; and even here, the monsoon is allowed to have set in some time ago. ... Nothing but the prospect of going down to the Western Coast, and the hopes of benefitting thereby, prevented my applying to be permitted to relinquish the survey when at Nuggur[3] ; ever since the first attack at Cowleydroog [pl. 11] I cannot say that I have enjoyed a day's good health, or a night's repose ; and from that stroke I have no idea of ever freely recovering ; my native air may be of use. Since the Rheumatism invaded my limbs so severely, it has almost deprived me of the use of them. ...

"A removal into a warmer climate may in some degree alleviate, though not remove, the severity of the Rheumatism, and stop its late discouraging symtoms ; but what resource can be found for the painful decays of constitution worn down by incessant toil and ill health ? Finding myself now no longer able to persevere in a pursuit to which I have dedicated my best days, ... I am under the necessity of earnestly requesting Government will be pleased to permit me to relinquish so very unequal a contest. ...

"I have, when health permitted, during these 12½ years, been almost constantly in the field, and pretty actively employed. ... The rains, which are so much against my complaints, having set in here seriously, I am very anxious to have your permission to retire to Bangalore, or some other Eastern District of Mysore beyond their influence"[4] [362].

Mackenzie did his best to persuade him from resigning so hastily, particularly as at this time he was the only experienced asst. with the svy., but Mather persisted, and after ref. to Govt., Mackenzie, with somewhat ill grace, allowed him to proceed to Madras in Sept., and in the following month Mather applied for a passage to Europe—a cabin to himself. After several months delay he was given formal permission to proceed to England with authority to draw his pension there. He embarked at Madras, 6–3–07, in the Company's ship *Asia*, landing at Gravesend 9–9–07, and was drowned six mo. later, apparently on sea-passage from London to Aberdeen.

Before sailing he made his will, 18–2–07 ; "As the interest on my property will at all events realise £200 per annum, I bequeath to my father Robert Mather, at the Mill of Newburgh, near Aberdeen, the annual sum of £100 ; and if my step-mother should survive him she shall have £60 a year for life.

"The other £100 a year for education and clothing of poor fishermen's sons of the Newburgh in the parish of Foveran. Also to the parson or Schoolmaster of Foveran, for lecturing and reading prayers once a week to the poor people of Foveran". After further provision for education in Foveran, and bursaries at Marischal College, he closed ; "My health being on the decline and Life uncertain, after committing my soul to God, I will and desire that this be considered my last Will and Testament, and I hope it will turn out well, and that my Lamp has burned for the good of mankind, should I never enjoy much more the fruits of my labours myself"[5].

The following account of his death is taken from *The Aberdeen Journal* of 31–5–09, reprinted in that paper's *Notes & Queries* of 28–10–1908. "Two Indian Manuscripts, written in the Sancrit Language, the property of the late Mr. John Mather, who, after being several times wrecked in the Eastern Seas[6], was unfortunately drowned with many others of his countrymen on the English coast in March 1808, have been sent by his father...to the...Principal of Marischal College, ... according to his declared intention. ...

"Being an excellent Surveyor and Draughtsman, he had agreed, at the request of several Gentlemen who applied to him, to survey and draw a map of his native country (Aberdeen), the profits of which he intended to apply to some charitable purpose in the city of Aberdeen".

MAXFIELD, William. Bo. Marine.

2/Lt. 5–4–03 ... Junr. Capt. 24–11–23 ; furl. 1823–4 ; ret. 9–7–25.

1804–6, on Lord Valentia's svy. of Red Sea [392], survg. Massawa and part of Abyssinia coast[7].

April to Oct. 1809, survr. with mission to Sind [168–9, 175].

For many years 1st Asst. to Mar. Survr., Bengal [296] ; 1816, survd. mouth of Hooghly and E. coast.

July 1817, comdg. svy. ship *Sophia*, brought Mackenzie from Madras to Calcutta.

MENZIES, William. Ben. Inf.
b. 20–6–1778. d. 3–1–61.

Ens. 24–1–1800 ... Capt. 17–5–15 ; furl. 1815 ; ret. 10–6–18.

Son of Wm. Menzies, writer of the customs ho. Edinburgh, and Elizabeth his wife.

m., Edinburgh, 13–8–11, Harriet Fordyce, dau. of Dr. Callender, of Craigforth.

Hodson, III (279).

Oct–Nov., 1805, survd. route of dett. in pursuit of Holkar, Thānesar to Hānsi[8] [59].

His later surveys in Chota Nāgpur did not meet with the SG.'s approval [44].

MONCRIEFF, Bryce [I, 356–7]. Bo. Engrs.
b. *c.* 1766. d. 10–1–02, Bombay.

Ens. (Inf.) 26–7–1785 ; (Engrs.) 14–1–1791.. CaptLieut. 8–1–1796.

16–2–1796, Asst. Survr., Bo. Est., in place of Emmitt [I, 132, 273, 337] ; 1795–1801, on svy. Malabar and Kanara [96, 108, 116, 167] ; from 1797, comdg. Pioneers in Malabar [323, 409].

1800–1, with Stevenson's force in Wynād [123, 386] ; leave to Bombay, joining Reynolds at Surat, to help with map [282] ; d. whilst on leave.

[1] MPC. 10–12–02. [2] Belūr, 48 O/16. [3] Nagar, or Bednur, 48 O/1 [pl. 11]. [4] From Mather, 16–6–06 ; MPC. 8–7–06. [5] Mad. Wills, 1809. An account of these bequests is given in *The Thanage of Fermartyn*. Wm. Temple. Aberdeen 1894 (598–9). [6] No particulars known. [7] Markham (7–9). [8] 53 C/13 to 44 O/16.

MONTEITH, William[1]. Mad. Engrs.
b. 1790. d. 18–4–64.

Lieut. 18–3–09 ... MGen. 23–11–41 ; ret. 10–12–47. Lt Gen. 28–11–54.

m., Marylebone, London, 23–8–31, Maria, dau. of Thos. Murdoch, of Portland Place ; their son, Wm. Elphinstone, b. 15–10–35, d., Bangalore, 21–10–41.

KLS., Persia.

1808, on mission to Persia, sailing with Malcolm from Bombay, 10–1–10.

March to May, 1810, with Macdonald survd. route from Bushire through Basra to Shirāz [175] and with him to England via Baghdād [419]. In pressing for allces. writes, 28–5–11 ; "The duty I have been employed on in Persia, reconnoitring and fixing on the proper Situations for Posts, is both expensive and difficult, as on no occasions have I had more than the allowance of Ensign of Engineers, without those of Adjutant which I formerly had in India"[2]. Eventually granted a donation by the Directors.

B Pol C. 9–1–18, Monteith's report on N. Persia and possibilities for defence ; "Remarks on the Provinces ceded by Persia to Russia, and on the frontier established by the Preliminary Treaty of 1813. ... The rapidity of my journey in the year 1815 through part of Georgia, Garya, and Kara-Baug, did not allow of a more exact chart of those provinces, more particularly as it was necessary to reject almost entirely the information furnished by the inhabitants. None of their accounts agreeing about the nature of the country, or the relative position of the places, the principal only are marked, or those where the regular stages are established. ... The castle of Erivan (though it has twice repulsed the Russian Army) is of no strength, being commanded on every side by hills within 600 yards ; the works are contemptible. ... An actual survey of the Frontier can only be made when the Russian and Persian Commissioners commence their operations in defining the exact limits of the respective territories"[3].

Was again in Persia in 1826, making svys. of Azerbaijan and Georgia—war between Russia and Persia regarding frontier—visits Tabriz to arrange release of Russian envoys—"The fort [of Ardebeel nr. Mt. Sevelund] was constructed by Major Monteith of the Madras Engineers, surveyor in Persia"[4].

MRIO. 93 (1–10) ; "Map of the provinces (chiefly in Persia) of Azubijan, Talish, Gilan, as surveyed by Lt. Col. W. Monteith, ... as also the countries of Georgia, Karabaugh, and the new Russian Provinces of the Black Sea, from routes principally performed by him". 1830–2. Scale 1" = 5m. Tree growth indicated by artistic green powdering over brush shading.

DDn. 232 (445–6), 16–11–33 ; sd. as actg. CE. Ft. St. George.

MONTGOMERIE, Duncan. Mad. Cav.
b. 30–7–89. d. 20–4–78.

Corn. 1–6–10 ... Capt. 21–12–26 ; Maj. 17–8–38. ret. 16–3–40 ; Hon. Lt Col. 28–11–54.

Son of Duncan Montgomerie, of Inverkeithling, co. Fife.

m., Madras, 17–1–25, Harriet Isabella Katherine, dau. of MGen. J. Durand, Mad. Est.

Oriental Club.

Arrd. Madras as cadet of Inf., the Directors writing, 6–4–09 ; "We have appointed Mr. Duncan Montgomerie, now a Cadet in the Infantry at your Presidency, to be a Cadet of Cavalry. ... Should Mr. Montgomerie prefer continuing in the Infantry, let us know".

March 1810, MMI., cl. V [321]. On completion of course, being an exceptionally good dmn., kept on with Mountford to reduce and compile the Instn. svys., into a one-inch map [129, 319 ; pl. 12].

MGO. 26–11–24, appd. DSG., Madras. [129, 149, 147, 214, 394].

MOORCROFT, William. Vet. Surg.
b. *c.* 1765, in Lancashire. d. Aug/Sept. 1825, Andkhui[5], Afghānistān.

ed. Liverpool as surg. ; studied vet. science in France, and practised several years in London.

DNB. ; DIB. ; Bio. note, *Moorcroft & Trebeck,* I [xviii to xlvii].

Left England May 1808 on appt. Vet. Surg. to Bengal Govt. and, 4–12–08, took over duty at Pusa, Bihār, as Supdt. of the Company's stud, plans for necessary buildings having been submitted by SG. in 1806.

Account of the stud, and appreciation of Moorcroft's work, is given by the GG., Lord Moira, who visited it in 1815. He writes on 16th Sept. at "Hadjipore[6], a little way up the Gunduck river. ... I went ashore to inspect part of the stud. ... The brood mares were what I had gone to see this afternoon. ... Dined at eight o'clock with Mr. Moorcroft...to meet a large party which he had invited from Patna. ...

"17th. ... I went ashore at down and had a large number of colts and fillies, chiefly two-year olds, led past me. It was impossible to see them and not be sensible how far the plan has answered towards introducing a better breed of horses into the country. ... Mares are given from the stud to the zemindars, ... to have the benefit of the stud horses gratis, and Government is to have the refusal of the produce at one year old for a hundred rupees. ... I have examined here about 600 horses of various breeds and crosses.

"18th. I went on shore at daybreak to look over Mr. Moorcroft's accounts"[7].

In 1812, after the British advance to the Sutlej [61–2], Moorcroft had visited the Punjab, and suggested that the stud be moved to the neighbourhood of Hissār in Hariāna[8].

From Sahāranpur, he obtained permission from the AGG., Fategarh, to make an expn. into Tibet to collect specimens of mountain ponies and long-haired goats, under the pretext of a visit to Lake Mānasarowar. He started from Rohilkhand through Garhwāl in May taking Hearsey as survr. [30–1, 404–5][9]. The Council at Ft. William were horrified to hear of this journey, as it lay through Gurkha territory and would surely lead to trouble [80].

These fears were justified, for on their return Moorcroft and Hearsey were arrested, and were for several days in fear of their lives. The Nepalese were undoubtedly much offended by two strangers travelling through their territories without permits, disguised as fakirs, and with a large following, which on the return journey included flocks of nearly 200 goats and other animals. Govt. had to intervene with a letter to Kātmandu before their release could be effected after 17 days close confinement[10] [80, 404].

Whilst in Tibet they were assisted by the family of Kishen Singh the famous explorer ; "Messrs Moorcroft and Hearsay were travelling in W. Tibet disguised as fakirs, and under the assumed names of Mayapori and Hargiri. They visited

[1] Called "Joe" by Macdonald [419]. [2] B Pol C. 15–11–11. [3] DDn. 144 (41). [4] Alexander (189, 281). [5] over 200 m. S. of Bukhāra. [6] Hājipur, 72 G/2. [7] Hastings' *Journal* (233). [8] B Pol C. 25–6–12 (63). [9] B to CD., Pol, 15–6–13 (31–40). [10] B Pol C. 18–11–12 (17), *et seq.*

Hundes and Gartok, but on their return journey were taken prisoners and detained at Daba Jong, some 80 miles N.W. of the Mānsarowar Lake. Deb Singh and Ber Singh (father and uncle of Kishen Singh) hastened to profer their good offices, a kindness which Moorcroft and Hearsay acknowledged; ... 'Under an idea that we were in want of funds they offered us a hoondee[1] on Sreenugger for a thousand rupees, to be paid at whatever period might suit our convenience, and either in money or goods, as might be most agreable to us. 25th August 1812' "[2].

The geographical results of this rash and adventurous journey, May to Nov. 1812, which had taken them over the Niti Pass and down to Mānasarower Lake, definitely confirmed that neither the Ganges nor the Gogra took their rise from that lake, but that the Sutlej did so. They had been the first Europeans since the early Jesuit missionaries (79) to visit Mānasarowar, and though neither of them had any real knowledge of svy., Moorcroft's journal and Hearsey's map were of the greatest interest to geographers[3] [40, 81].

What had inspired Moorcroft's journey was not so much any thirst for geographical knowledge as the commercial possibilities of the long-haired goat, its value to the Company's revenues, and the possibility of its breeding in India.

With a view to making more extensive travels in search of horses from Turkistān, Moorcroft despatched Saiyad Mir Izzat Ullah to reconnoitre routes to Bukhāra via Kashgar whilst he visited Mānasarowar. The Saiyad left detailed journals of his travels, stage by stage, with interesting comments[4], though he was not himself able to reach Bukhāra. Leaving Attock in August 1812, he travelled via Hazāra, Kashmir, Leh, and Yarkand, to Kashgar, and returned to India in December 1813. It was in pursuit of this same quest that Moorcroft made the adventurous journeys between 1822 and 1825 that led to his tragic death. His accurate recording of details contributed greatly to knowledge of the Himālaya and of the countries beyond the NW. frontier.

MORISON, William. Mad. Art.

b. 5–2–1781. d. 15–5–51.

Lieut. 31–12–1800 ... M Gen. 23–11–41.

Son of James Morison, of co. Clackmannan, Scotland, and Jean Haig his wife.

CB. 1820[5]; KCB. 27–4–48; FRS.; FRAstS.; MP for Clackmannan for 9 years.

Oriental Club.; Begbie, II; *JRAS.* (*nn*), XII. 1852 (94).

DDn. 41, Mackenzie recds. him for appt. to Mysore svy., 18–6–02, "being satisfied of his qualification for that duty by a regular education in the mathematics, & other branches of science particularly requisite for that line, under a Professor of eminence, with the further advantage of being employed on actual survey with a surveyor of extensive practice at Home [119]".

Appd. to join Mackenzie "on the 6th July, ... to acquire some knowledge of the manner in which the surveys have been carried on; ... he should set off before the monsoons commence. He also attends the Observatory" [101 n.9, 102]. Left for Mysore Oct. 1802, and started work nr. Seringapatam, keeping an interesting journal [208, 212];

"November 14th. Marched to the summit of Beeswancul Betta[6], to measure angles; this is a lofty and rugged mountain about five miles west of Nagmunglum, surrounded by jungle for several miles on every side. ... The jungle around is famous for its tigers, and the natives declined to accompany me before the hour of twelve, or to remain there later than four o'clock P.M., as they said the tigers came abroad morning and evening. I was, however, on the summit till nearly four o'clock; they had provided themselves with tom-toms and horns with which they made great noise to keep off the wild beasts. They were the more alarmed as a cowherd had been killed very near this, the day before [378]. ...

"30th. Went to the top of Hatty Betta for the purpose of measuring angles. ... Hatty Betta is a rugged mountain near Nagmunglum[7] [pl. 11]...and is quite covered with huge rocks and thick jungle. On my way hither I outmarched my people and was conducted by a guide from a neighbouring village. I followed him by a winding causeway which was in some places very steep, and had steps laid across to make the ascent less difficult. Near the summit we came to perpendicular rock of about forty or fifty feet high, at the foot of which there is a common hindoo building. ... This I perceived covered the entrance of a natural cavern which goes into the rock about 32 yards; about 19 from the entrance, water commences which covers the bottom to the furthest extremity; it is about knee-deep and of excellent quality.

"The door is built in a regular manner, and immediately within it the roof is about nine feet high, ... then lowers... [to] six feet high; from the entrance to this part the roof is a regular circular arch, as if it had been cut with the greatest care. ... I was informed that numbers of the natives visited this place occasionally to worship a swamy which they informed me was under the water. When I went into the water to pace the cavern's extent...they endeavoured to dissuade me by saying it was very deep and dangerous, which I found to be false. They never come singly as the mountain is at times infested by tigers".

Early in 1803 preparations were commenced for the campaign against the Marāthas [102], and Mackenzie wrote to Morison, 19–2–03. "I am glad you are going on so well with the survey, and shall be happy indeed if the state of affairs do not render it necessary to take away any of the military men from that duty. As neither Major Lambton nor [Lieut.] Warren are called away, I think it highly probable that none of my assistants will be called off, at least unless there is a necessity for officers attending their duties in the field, and then everyone will of course fly to his duty with alacrity; in other respects all of you ought to remain quietly at the post where Government who are the best judges, think proper to employ you" [421].

Morison was, however, called away to his unit and, though Mackenzie had hopes of his return in October after recovery from a bout of sickness, continued on mil. service, Mackenzie writing, 6–1–04; "The success of the army against the Mahrattas is very brilliant, and I hope the plunder of their forts will enrich some of your acquaintances. What a pity that you could not get there; since you were not permitted to benefit by your appointment to the survey, it is certainly very hard to be deprived of both".

Feb. 1809, Morison became Sec. to the Mil. Bd., after having been Dep. Sec. since Oct. 1804. He acted as MS. during the three months Petrie acted as Govr. at the end of 1807 [265 n.3], and on the institution of the new Commt. Dept. at the end of 1810, he became the first Commy. Gen.

During Mackenzie's absence on the Java expn., April 1811 to March 1815, Morison acted as SG. Madras in addition to his other duties [3, 129, 162, 163, 276, 299, 302–3, 325, 382].

After holding ch. of Commt. Dept. for 15 years he became Resdt., first in Travancore, and then in Mysore. In 1834 he joined Supreme Council at Ft. William, remaining there 5 years. Returned to England in 1840, after 40 years unbroken service in India [312].

Autograph will be found on pl. 14.

[1] bill of exchange. [2] Black (152); Burrard & Hayden (190). [3] Murray, II (404–25). [4] Translated from the Persian, *Travels in Central Asia...1812–13*. [5] *London Gaz.* 8–9–20; elsewhere given 21–9–21. [6] Basavankal, 57 D/9. [7] Hatti Betta, 3045 ft.; Nagamangala, 57 D/13.

MORRIESON, Hugh. Ben. Inf.
b. 1–12–1788. d. 27–5–59, Edinburgh.

Ens. 28–8–04 ... Lt Col. 13–1–34; ret. 11–8–41; Hon. Col. 28–11–54.

Son of David Morrieson, Maj. Ben. Inf. (d. 1809) and Rachel his wife; bro. to Wm. E. Morrieson [*inf*].

m., 11–8–44, Elizabeth Constantia, dau. of Richard Pryce and widow of Capt. Robt. Campbell, RN.

Hodson, III (333).

From 1805 with 4th. NI., being taught svy. by Charles Crawford of that regt., and, BMC. 2–5–12, appd. from Benares at Crawford's request to assist him on svy. of Mirzāpur [45, 312, 392]. On Crawford becoming SG., Morrieson was appd., BGO. 8–5–13, asst. to his bro. Wm. on the Sunderbans svy. [6, 16, 17], taking over ch. on the latter's transfer [*inf.*].

Feb. 1815, Nepāl War, joined his corps at Cuttack.

1815–6, actg. ASG. [397].

1816–8, continued svy. of Sunderbans, becoming AQMG. 1–1–17; see Vol. III.

MORRIESON, William Elliot. Ben. Engrs.
b. 5–4–1791, Edinburgh. d. 6–1–15, of wounds received in action, Jītpur, 3–1–15.

Ens. 13–6–07 ... Lieut. 9–2–10.

Bro. to David (1783–1821), BCS—to Hugh [*sup*]—to Robert (b. 1787), BCS—and to Nasmyth (d. Dec. 1846), Nizām's army, who contributed paper "Trisection of an Angle" to *JASB*, vol. II.

Hodson, III (335).

Dec. 1809 to May 1810, Survr. to Martindell's dett. in Bundelkhand [6, 49–51, 134, 289, 358]; 17–1–10, writes to SG. from "Hirapoor[1]. ... I have been favoured with your kind letter of the 28th December 1809, and take advantage of our making a halt at this place to acknowledge its receipt and to enclose a copy of my book from Chatterpore[2]. Having as yet been unaccustomed to the work, and not being provided with a regular copy for a field book, I have adopted the method which appears most easy and distinct. ...

"I learnt a little astronomy and spherical trigonometry along with my other mathematical studies before going to Woolwich, but fear I am now somewhat rusty. ... Orders are out for our again marching tomorrow [228]. ... With best regards to Mrs. Garstin[3]".

Complained bitterly of his svy. allce. being cut for recovery of cost of very inferior insts. supplied by commt. [223, 329][4].

Rejoined corps. at Benares at end of May.

BMC. 8–2–11, being recdd. by SG., was appd. to svy. of Sundarbans, BGO. 2–4–11, starting work 20th April [365]. For three years he carried on svy., stopped only by monsoon between July and Oct., and completed a large tract of the tedious country E. of the Hooghly [6, 7, 14–7, 177]. Work lay mostly through dense *sundra* forest, teeming with tigers [17]; "charcoal burners and woodcutters had holy men in attendance to preserve them from tigers, the surveyors had no such protection". ... Morrieson records that one evening, in 1812; "whilst the people were cooking their dinners on the banks of Saugor Island, a tiger sprang upon an old dandie[5]; one of my sepoys advanced with a hatchet, and is said to have hit the tiger on the head; the blow was fatal to himself, for the tiger left the old man, who was not much hurt, and carried off the sepoy. ...

"At half-past three in the morning, a tiger came on board a boat, and killed my Jemadar after causing much alarm. ... The manjies today protested against returning to the jungles, both on account of the tigers, and by their boats being much damaged by worms [17]. ...

"This day a man by the name of Gunga Ram, manjee to one of the boats, was carried off by a tiger. The wind was high, and the ebb having set in he could not reach the place he wished to anchor in, and as he was driven near the shore, he went on the mud with the towline in his hand; all the other people on board advised him not to go. He had not been above a minute on shore when the tiger sprung upon him and carried him off[6]".

He discusses the reclamation of the Sundarbans for cultivation; "I have no hesitation in giving it as my opinion that whatever impression has been made on the Jungle has been accomplished by bunding. Where the bunds are neglected, and the Salt Water inundates the cultivation, it is immediately destroyed.

"The woods of the Sundarbans only thrive in Salt Water, and the only sure way of clearing the lands is by first keeping out the Spring Tides which inundate the whole of the Sundarbunds I have visited"[7].

May 1814, handed over to his bro. Hugh, who had been appd. his asst. twelve months before [311, 312], and was himself appd. "station engineer" at Chunār[8], and specially commissioned "to superintend the construction of the Mausoleum at Ghazeepore over the place of internment of the late Marquis Cornwallis...from the 1st proximo" [31 n.1, 310, 383, 443][9].

Nepāl War, 1814, posted to Gen. Wood's force operating from Gorakhpur and made occasional svys. in the *turai*. Was fatally wounded at an unsuccessful "attack on a Goorkha stockade near Bootwul[10] (Jeetgur), attributed to a treacherous guide. On the morning of 3rd. the force was led to within twenty yards of the stockade, the enemy being concealed in thick grass jungle, and the grass and jungle cleared from approach by which General Wood's force was led, and they came under a brisk fire. Five officers and many men were knocked down; Lieutenant Morrieson of the Engineers [was hit] near the hip joint, the ball passing fairly thro' from one side to the other"[11].

Left bequests to his mother, of Edinburgh; to his bro. David and his wife; and bros. Robert and Hugh, all in India. Also to his sister and two other bros., one being Alexander, an accountant in Edinburgh. "Also in token of his long attachment to Miss Mary Churchill, daughter of Captain Churchill[12] of Calcutta, a sum of Rs. 1000"[13].

MOUNTFORD, Francis. Mad. Inf.
bapt. 23–7–1790. d. 11–7–24, Madras.

Ens. 25–10–09[14] ... Bt. Capt. 30–4–23.

Son of Thomas Mountford.

m., Madras, 13–1–23, Miss Emily Haselwood [410, 410].

March 1810, MMI., cl. V [320]; MGO. 17–7–12, kept with Montgomerie to compile and draw MMI. svys. on reduced scales, completed in Feb. 1815 [129–30, 319, 430].

[1] Hirāpur, 54 P/3. [2] Chhatarpur, 54 P/9. [3] DDn. 82 (146). [4] ib. (135). [5] boatman [I, 283]. [6] Sherwill. [7] Note on map dated 1–7–14; MRIO. Misc. 2–0–14. [8] *v.* Hastings' *Journal* (6). [9] BMC. 18–6–14. [10] Butwal, 63 M/6. [11] Letter from Gen. Wood's camp, 4–1–15; *CG.* 19–1–15. *v. Nepaul Papers* (127, 525). [12] Henry Churchill; arrd. India in comd. of *Walpole*; Marine Pymr. & storekeeper, and at one time Sheriff, Calcutta; m., Calcutta, 15–11–1780, Mary, dau. of R. C. Birch, BCS.; Hickey, III (295–8, 322), IV (326, 343–4). [13] Ben. Wills, 1815. [14] MGO. 31–12–11.

MMC. 1–7–15, appd. to act as Asst. Instr. at MMI., and 1816, re-employed to draw maps from latest svys. of Instn.

1817, appd. to svy. Guntūr; 1818, to ch. of SGO. Madras, holding post till death.

MUNRO, Thomas. Mad. Inf.
b. 27–5–1761. d. 6–7–27, of cholera, Pattikonda, Kurnool Dist.

Ens. 20–5–1779 ... MGen. Aug. 1819; Govr. of Madras, 1820 till death.

Son of Alexander Munro of Glascow. ed. Glascow.

m., 30–3–14, Miss Jane Campbell, from Craigie Ho. Ayrshire.

CB. 1818; KCB. 1819; Bart. 1826.

DNB. DIB.; EIMC. III; Gleig, with portrait, vol. I; Arbuthnot; Bradshaw; *Times* 6–10–1942, portrait by Raeburn sold for £ 682–10s at Christie's; portrait by Archer-Shee VM. Exbt. 342; engraving at IO. (Foster, 89).

Aug. 1788, appd. asst., Intelligence Dept., under Alex. Read [I, 369], and attd. to hdqrs. of force occupying Guntūr [I, 111]. Mysore War, 1791-2, on transport and supply duties under Read.

April 1792 to 1799, asst. to Read on rev. admn. in Bāramahāl [I, 144–5]. 1799, Sec. to Mysore Comn. [I, 119]. From July 1799, in civ. ch. of Kanara, making settlement of rev. based on ancient records [96, 158].

Oct. 1800, tr. to civil ch. of Ceded Dists., which he held till Oct. 1807 [366–7]. Completed settlement of revenues, establishing procedure of regular *ryotwāri* svy. through agent of Indian survrs. and inspectors. His system was a development of that employed by Read in Bāramahāl, and in its turn became the guide for future rev. svys., more particularly in Bombay Presdcy. [8, 152, 180–2].

1808 to 1814, England; 1814–7, re-employed in Madras as principal comnr. for revision of internal admn. [182–4]. Warm advocate of extended employment of Indians.

1816–8, Comdd. column in S. Marātha Deccan as Brig. Gen.

MURRAY, William. Mad. Inf.
b. 11–3–1789. d. 8–1–35.

Lieut. 17–7–05 ... Maj. 31–5–33.

Son of James Murray, merch., of Aberdeen.

m., Edinburgh, 3–4–23, Elizabeth, dau. of Wm. Rose, and widow of Col. Alex. Campbell.

April 1806, MMI., cl. II [320]; 1810, on mil. svy. at Tellicherry, Malabar; 1811, on svy. under Arthur in Travancore [132], and detached to N. Malabar.

NELTHROPP, Christian Leonard. Mad. Inf.
b. 2–12–1789, Copenhagen.
d. 16–7–21, Chitaldroog.

Lieut. 17–7–05 ... Bt. Capt. 8–1–19.

Son of Henrick Nelthropp, manufacturer, of Copenhagen.

m., 31–8–18, Miss Mary Anne Dickey.

April 1806, MMI., cl. II [320]; MGO. 9–10–10, attd. to QMG.'s Dept.; MMC. 29–1–11, having completed 2 years 3 months regtl. duty, recd. for svy. branch, QMG.'s Dept. MMC. 2–4–12, being on svy. in Salem Dist., complains of lack of asstce. from Collr.

MGO. 21–1–15, appd. to 1st cl. of svy. branch [164, 322]; MMC. 22–7–16, with QMG.'s Dept. on fd. service.

Mad. Courier of July 1821 gives following account of his death; "A lamentable accident occurred on 16th July. Captain Nelthropp and Ensign Powell[1], of the 2nd Batt. 14th Regt. NI., were blown up by an explosion of damaged gunpowder, which it appears had been thrown down incautiously into a deep dyke by the lascars of the garrison, into which the two unfortunate officers were rolling large stones, by which the powder took fire and, exploding, blew these poor gentlemen into atoms."

Com Cor. 6–8–26; Directors refuse widow's petition for special pension.

NEWPORT, Christopher. Bo. Inf.
bapt. 1–11–1788. d. 15–8–44.

Ens. 25–6–09 ... Capt. 1–5–24; ret. (as Bt. Maj.) 5–1–42.

Son of Wm. Newport of London.

m., Exeter, 1830, Ann Hoblyn, dau. of Rev. Edward Peter.

Oriental Club.

April 1812, joined Broach rev. svy. [323]; continued on rev. svy. till 1829, mostly in Gujarāt.

NICHOLLS, Charles George. Mar. Survr. & Dmn.
Arrd. Calcutta, probably as mariner, either 1792 or 1796.

1799, "admitted a Draughtsman in the Office of the Surveyor General, having been instructed in those branches of learning.

"1802, ... Directed to proceed on board of the Tiger Gun Vessel to survey Orissa and the adjacent coast [10, 11], where he contracted an Epidemic Fever, and...constitution greatly debilitated.

"1807, The Surveyor General, being deputed on a Survey of the Ceded & Conquered Provinces, took with him the greater part of his Establishment, and [Mr.] Nicholls was the only Draughtsman left in the office"[2] [272 n.9, 273].

1808, asked Govt. support for a new and revised map of Calcutta [17]. Many examples of his beautiful drawing are preserved, as in pls. 4 & 7, and in chart of Chittagong Coast comprising survey of Upjohn & Robertson[3].

Pay increased to Rs. 200 in 1801; on appn. to retire on account of "extreme weakness of his sight and the pain which he frequently feels in his Eyes", granted pension Rs. 150 pm. from 28–4–15.

Though not known by Mackenzie in 1818, name still shown in *Cal AR.* for 1824.

NISBETT, Harry. Ben. Engrs. & BCS.
b. 11–11–1794. d. 6–12–90.
Ens. 1814. tr. to BCS. with antedate to 30–4–14.

Son of Walter Nisbett and Anne his wife, dau. of Robt. Parry.

m., Quedgeley Gloucs., 19–2–28, Anne Curtis-Hayward.

ed. Marlow; Addiscombe, 1809–10.

Hodson, III (397).

1812–3, as cadet, Asst. Survr. with Smyth in Chota Nāgpur [45, 311 n.2, 312].

15–7–14, appd. to svy. Chittagong Dist., but tr. following month to civ. [19].

NUTT, Justinian. Bo. Engrs.
b. 1–11–1786. d. 18–7–53.

Lieut. 7–1–05 ... Maj. 10–4–30.

Son of George Nutt; possibly nephew of Justinian Nutt, comdg. EIC.'s ship *Duke of Kingston*, 1780.

[1] John Moore Powell (1803–21); Mad. Inf.; son of Philip Lewis Powell, Lt. RM. 1796–1801. [2] Statement of services with appn. for pension; BMC. 28–4–15 (95). [3] MRIO. 100 (25).

ed. RMA.

Lieut. Fwkr. Bo. Art. 1–5–04 ; tr. to Bo. Engrs. 17–10–04.

Bo MC. 17–4–07, appd. Asst. to SG. with allce. Rs. 120 pm. [338] ; Dec. 1808, on svy. of Gujarāt frontier [171], but soon proceeded overseas on mc. [323].

Bo GO. 6–4–11, attd. to SG.s' Dept. on salary Rs. 250 pm. [188] ; He writes himself that "in execution of these duties I was unfortunately taken ill, and reluctantly compelled to the very heavy, but unavoidable, expense of visiting a distant country. ... Although permission was granted me to proceed to St. Helena, yet the very favourable accounts I received of the salubrity of the climate of the Isle of France on arriving at Ceylon determined me...to try the air of that quarter. ... In this expectation, however, as the sequel proved, I was but too unfortunately disappointed"[1] [418].

Proceeded on sick leave Jan. 1812, SG. reporting, 12–10–12 ; "Letters have lately been received from him dated at the Mauritius, by which it appears that his health is restored, and he intends taking the first opportunity of joining"[2]. He did not return to India till the end of 1813, and was appd. under Bo GO. 31–1–14 Asst. Rev. Survr., Bombay & Salsette, under Dickinson, with allces. Rs. 250 pm. [187, 323].

He did not serve long under Dickinson, and the records contain a series of long angry letters from both officers, describing a most unhappy inspection made by Dickinson during March 1814 [395]. Extracts give interesting details of survey methods. In reply to a complaint which Nutt made to Govt., Dickinson writes, 27–3–14 ;

"On examining the theodolite...I found the legs of the stand very unsteady, and immediately sent for Mr. Nutt to enquire whether he had taken any angles with the Instrument in that state ; on his replying that he had, my remark was 'How could you in your senses have done such a thing'. ...

"The next question I had occasion to put...was ; "Which is your first station, or from what point do you propose commencing the measurement of your Base Line?' On showing me which, I merely observed that, for the excellent reasons I had given him in writing, it would not only be improper, but in direct opposition to the letter and meaning of those instructions".

After describing many details in which Nutt failed to observe elementary precautions, Dickinson continues ; "Repeatedly during the measurement of the Base Line of 3½ miles in length, I had occasion to point out to all present several very glaring oversights and irregularities. ...

"Although before leaving our Tents I invariably mentioned the object for which we were going out, it frequently happened that something essential was forgotten, on which occasion I addressed myself generally to those present in terms of censure.

"On assembling at the office Tent after returning from our morning work, I was surprised at Mr. Nutt's asking me whether there was anything that he could do in the office ? to which I replied, 'Have you really prepared or done nothing ?', and on further enquiry I had the mortification to find that he had neither made use of pen, Ink, paper, or Instrument ; upon which I pointed out to him how much might have been done. ...

"Again, on the last morning, I was sadly disapponted to find that he had taken for a station a spot where, without imminent danger, it was almost impossible to fix the instrument, and with most excellent ground all round us ; this caused us serious and very considerable detention, for which, and the very shameful manner in which it and all of the flags had been put in the ground, I did not hesitate to reprimand Messrs Nutt and Tate.

"Having with great difficulty fixed the instrument, I observed to Lieutenant Nutt that he appeared to be levelling it on no fixed principle, and asked him to explain what he was about ? He did not, neither could he, explain, but simply said he knew how. I returned, 'Your manner convinces me that you are a stranger to the Method, and since you seem unwilling to give a direct reply to my question, will you be so good as to touch the proper adjusting screw?' upon which he put his finger on the wrong one, and a second time touched the wrong one. I felt so ashamed for him, that I merely said I could scarcely credit what I saw"[3]. Altogether a most uncomfortable picnic.

After Govt. had accepted his resn., Nutt threw in a final shot, a long letter answering each one of Dickinson's many points separately, and insisting that there had been nothing so very wrong with his professional work as to call for the rebukes showered upon him.

"Captain Dickinson had written so strongly of the beauty and excellence of the theodolite that I deemed an examination of it unnecessary after taking it out of the box ; however, at Mr. Macleod remarking to Mr. Tate that one of the legs appeared a little unsteady, I, in consequence, paid the more attention to the fixing them all firm to the ground ; the angles were then taken, and with the utmost accuracy, since on the completion of the whole the first operation was repeated, and the variation of a few seconds only observed. ...

"In the instructions I can find nothing relating to the particular position which either I, or Mr. Tate, was to take for the plumb direction of the flag staff ; I presume, however, before quitting it we should have naturally placed it upright. ...

"In respect to the several glaring oversights and irregularities, I can enumerate but the following ; the names of 10 Lascars having been called over immediately on commencing the measurement of the Base Line, I had occasion soon after to speak to them, when, not recollecting some of their names, Captain Dickinson observed that it was a most extraordinary circumstance I should have forgotten them, and on my answering that I had no doubt but they would all become familiar to me in a day or two, he said he would relieve me from the duty if I found myself incapable of discharging it. ...

"What is meant by 'it frequently happened that something essential was forgotten' I cannot explain, though one day...I well remember that something was accidentally missing, viz., a Crow Bar, when Captain Dickinson, after expressing his great surprise at the neglect, declared we were all, Messrs Tate, Macleod, and myself, equally in fault, and he would not but believe it had been left behind intentionally.

"One motive for Captain Dickinson's visiting Salsette was to acquaint us with the mode and form in which he desired things to be conducted ; was it not therefore natural I should require what was to be done in the office? and as to the mortification at finding that neither pen, ink, nor paper had been employed, no necessity whatever...existed for the two former, but the latter, together with pencil, had been used when required. ... "

Regarding the next episode, "This was our principal station, the flagstaff of which, for greater security, had not only been fastened by three ropes, but had likewise around it a pile of rocks of a conical form ; these were whitewashed to render them visible at the further extremity of the districts. Captain Dickinson, however, on attaining the summit of the hill, instantly condemned the situation, damned the rocks, and declared he had never seen so little attention paid to the securing of a flag". ...

And about the level adjustment ; "To the best of my knowledge no such conversation...ever took place, and that so far from my mode of levelling having for its basis no fixed principle, it is that which is practised by the Surveyor General on this Establishment, and also by those employed on the Trigonometrical Survey in England, and recommended, I believe, by all authors who have written on the subject ; whether so much can be said in favor of Captain Dickinson's method I very much doubt indeed".

"Respecting Captain Dickinson's complaint of the severity of my animadversions, the confession made in the commence-

[1] Letter from Nutt 15–2–14 ; Bo MC. 2–3–14. [2] Bo RC. 20–10–12. [3] ib. 5–4–14.

ment of his own letter affords a complete refutation ; and, indeed, on a calm and dispassionate review of the whole of the case, I might...add the terms harsh and unmerited, even admitting the validity of all he has advanced. ...

"I cannot but think that Captain Dickinson...must have supposed my feeling completely callous to all sense of reproach and reprimand. I thank God, however, that is not the case. ... If, indeed, upbraiding and reproof are to be used on every trifling, insignificant, occasion, away of course will soon go all confidence, and as naturally must zeal for the service be converted into disgust.

"I cannot conclude without expressing my deep and sincere regret at Captain Dickinson's not having complied with my request in the first instance of coming over to Salsette, and communicating in a full and friendly manner his wishes and intentions, since I feel persuaded it would not only have been the means of rendering the duty a pleasure, instead of a *task*, but I think he would have had no reason to lament the confidence he might have reposed in Mr. Tate or myself. ...

"Until serving under Captain Dickinson, I never received a censure or reprimand from any officer to whom it has been my lot to be attached. Captain William's report dated Baroche, 1811...is couched in terms far, very far indeed, different from the language of reproof, the reproof too, I feel the more keenly as coming from one who quitted the Royal Military Academy at Woolwich only a short time previously to my joining that seminary, and has consequently not been much longer in the army than myself"[1].

Nutt was not again employed on svy. He did excellent service as engr. throughout the Marātha War, and was mentioned in GO. of GG. in C. dated 26–9–18 ; "Captain Nutt, of the Bombay Establishment, who conducted the Engineer's Department on some occasions, has been deservedly applauded for zeal and activity and science".

O'DONEL, Hugh. Ben. Inf.

b. 2–7–1785. d. 27–9–37, Nasirābād, Rājputāna ; MI.

Ens. 7–4–05 ... Lt Col. 13–8–35.

Son of Francis O'Donel, of Kilcommon, co. Mayo, and Catherine his wife.

m., Dināj pur, Bengal, 1–12–26, Miss Jane Finch.

Hodson, III.

1811–3, with Rāmgarh Batt. ; DDn. 270 (36), survd. various marches under Roughsedge on frontiers of Chota Nāgpur and Palāmau [439–40] ; 1813. survd. route through Shahpur[2] and Surguja [47, 312].

O'DONNOGHUE, John Jeffery. Mad. Inf.

b. 6–7–1786. d. 13–1–60.

Lieut. 21–9–04 ... Maj. 23–4–28 ... ret. 4–6–30 ; Hon. Lt Col. 28–11–54.

Son of Elizabeth O'Donnoghue, of Cork.

m., Laugharne, co. Carmarthen, 8–1–29, Theodosia Catherine, dau. of Rev. Wm. Hamilton.

April 1805, MMI., cl. I [320] ; Aug. 1805 and Feb.–April 1806, svys. of Madras town.

MGO. 5–4–11, to rejoin his unit, having been employed on svy. near Jālna, under QMG., for more than a year [50 n.6, 134].

ib. 5–1–13, appd. Asst. in svy. branch, QMG.'s Dept. [322] ; promoted to 1st cl. 21–1–15.

MMC. 15–11–14, appd. temporary AQMG. to force assembling in Deccan ; survd. routes during campaigns 1816–7 ; 11–5–18, thanked by Munro for able assistance before Sholāpur.

1824–5, mentioned several times in despatches on siege of Kittur[3], and operations in S. Marātha Deccan.

1823–8, QMG. Fd. force in Deccan.

OLLIVER, Joseph. Civ. Asst., GTS.

b. 1786.

Appce. Survr. 13–3–1800 ; Sub-Asst., Sept. 1804 ... Principal Sub-Asst. 11–3–24 ; Ch. Civ. Asst. 4–6–32 ; ret. 1842.

1800, appd. to survg. school, Madras ; 1804–6, asst. with Kater on Lambton's svy., returning to the school on Kater's departure. MMC. 11–3–07, posted to Lambton's svy. [346, 352] ; MPC. 11–6–13, Lambton reports him, 19–5–13, "a young man of good behaviour, of promising talents, and...hitherto exceedingly attentive to his duty" [164].

Had long career in GTS., being left in ch. during Everest's absence in England, 1825–30.

OVANS, Charles. Bo. Inf.

b. 20–9–1793. d. 19–7–58.

Ens. 25–7–09 ... Lt Col. 5–9–35 ; MGen. 1854.

Son of David Ovans of Tweedmouth.

m., Tweedmouth, 25–11–34, Jessy, dau. of John Robertson.

Oriental Club.

March 1812, appd. to rev. svy. Broach [323], and continued on rev. svy. till 1829.

1838, Resdt. Satāra.

PARLBY, Samuel. Ben. Art.

bapt. 9–5–1789. d. 21–3–78.

Lieut. 28–3–06 ... Maj. 26–9–30 ; ret. 3–3–31 ; Hon. Lt Col. 28–11–54.

Son of Rev. Samuel Parlby, later of Wickham Market, Suffolk, and Ann Cook his wife.

m., 1st., Baxted, 23–9–17, Anne, dau. of Rev. Dr. Thos. Redman Hooker.

m., 2nd., Cape Town, 29–8–31, Hester, dau. of Capt. Hungerford Vowe, late RM.

ed. RMA. Hodson III (462).

1809–16, with Horse Art. ; 1811, survd. Meerut Cant. [28].

1820–30, employed on manufacture and ch. of explosives, Dum Dum and Allahābād.

1822–7, ed. *The British Indian Military Repository*, 3 vols.

PATERSON, James. Ben. Cav.

b. 25–6–1784. d. 10–1–50.

Corn. 24–6–1800 ... Capt. 1–1–19 ; ret. 13–5–19.

Son of Dr. George Paterson, JP., co. Perth, and his wife, the Hon. Anne Gray, dau. of John, 12th Lord Gray.

m., 3–9–21, Davie, dau. of David Erskine.

Hodson, III (470).

1810, survd. route of 4th NC. Ludhiāna to Sahāranpur ; 16–10–10 to 7–1–11, survd. route Karnāl to Kalewar [65].

DDn. 270 (21), 24–5–14, whilst "studying in the College of Fort William", address 17 South Barracks, asks permission to attend SG.'s classes in astronomy [193], and in letter of 28–5–14 Hodgson suggests his appt. to proposed svy. into the Himālaya ; "A friend of mine, Lieutenant Paterson, who is of a philosophical turn (and is as well an expert Astronomer & Surveyor) would be very happy to get leave of absence to be a volunteer on such an expedition" [84]. The Nepāl War put an end to such plans.

Feb–March 1816, survd. route from Bhagwānpur to Pipaldhar[4] during Ochterlony's advance into Nepāl [43].

Aug. 1817, on svy. in Bundelkhand ; very neat map from Kaitah on west to Kālinjar on east ; MRIO. 83 (24).

[1] Letter dated 7–4–14 ; Bo RC. 27–4–14. [2] 64 I, M. [3] 48 I/14, 25 m. S. of Belgaum. [4] 72 F/1.

PATON, John Forbes. Ben. Engrs.
b. 1796–7. d. at sea, 7–2–27.

Ens. 6–5–15 ... Capt. 10–5–23.
Son of John Paton [1763–1824], Ben. Inf., QMG. Bengal 1808–20, and Mary his wife.
ed. Edinburgh High School; Addiscombe, 1811–2.
m., Calcutta, 22–4–20, Emily, dau. of Hugh Stafford, Ben. Inf.
Hodson, III (475–6).

BGO. 30–9–14, appd. with Edward Garstin, both being still cadets, asst. survr. under Hodgson with Marley's Div. on Nepāl frontier [41, 42, 312, 408]; continued svy. till end of March 1815.

1815–6, with Hodgson as asst. survr. to svy. of Sirmūr and Nālāgarh; both Paton and Garstin resd., 15–11–16, as they could not keep up necessary transport in the hills on their meagre allces. [399–400]

1818, Marātha War; survd. routes of MGen. Brown's dett. in pursuit of *pindāris*, Nimach–Jawud–Nasirābād–Narwar; decorated them with most effective sketches in sepia[1].

PATRICKSON, William Gould. Ben. Inf.
b. *c.* 1779. d. 21–8–42.

Ens. 3–10–1798 ... Lt Col. 22–10–24; ret. 22–4–27.
Hodson, III (476).
May 1806, survd. route Cuttack to Sambalpur, "with treasure" [23].

PECKETT, James. Ben. Engrs.
b. 27–3–1791. d. 5–12–48, Calcutta.

Ens. 18–11–08 ... Col. 13–3–44.
Son of James & Charlotte Peckett. ed. RMA.
m., 23–4–23. Catherine Gordon, dau. of Robert Hepburn.
Hodson, III (494).
Tr., 14–11–09, from art. to Engrs. with ante-date; 1810, after studying astronomy in Calcutta [192], sent to Cuttack for training in svy. under Sackville, who reported very favourably on his work, 12–4–11 [25].
DDn. 126 (106), instructed by SG., 14–9–11, to proceed to Patna and svy. alternative lines for road to Gaya, [19, 312]; "The maps of this part of the country are very defective, which your survey of these two lines will in some degree serve to correct. Much care must be taken to observe the levels. ... You will return from Gaya by the Hilsah road[2], and as soon as those two surveys are completed, will form... estimates of the number of solid feet of Earth to be removed to make the Roads, marking on the surveys the average height they are to be raised from place to place; and you will enquire the usual expense of digging tanks near those towns they pass, which will show the rate of labour per 100 solid feet".

Garstin, SG., reported on the svy., 29–8–12, "Having resided many years at Patna [400], and traversed the country in question at all seasons, and in almost every direction", recds. a line "Hurdev...and Colligange, to Sailgange close to Gyah"; "Ensign Peckett's survey...has undoubtedly proved a very laborious one. He appears to have spared no labour to make it correct and perfect. It is an extensive survey, remote from any station, involving a heavy expense for instruments, Camp Equipage, etc., and a number of servants", and he recds. that Peckett should draw full survr.'s allces.

1812, Peckett survd. city & suburbs of Patna, scale 2″ to a mile[3].

PERRY, James. Mad. Inf.
b., Bath., 12–6–1790. d. 17–3–63.

Ens. 27–6–06 ... Lt Col. 13–7–31; Lt Gen. 6–12–56.
m., 1st., Madras, 3–7–26, Elizabeth, dau. of Lt Col. Wm. Read, Brit. Army.
m., 2nd., London, 18–12–50, Ida, dau. of Capt. J. E. Parlby. *Oriental Club.*

June 1807, MMI. cl. III [320]; 1810, planetabling under Garling towards Pulicat [127]; Nov. 1810, route svy. Bangalore to Mangalore; 1810–11, on svy. of Goa [156 n.5, 399], being relieved, 30–6–11, and allowed 6 weeks to finish drawing before joining his corps.

MGO. 6–10–12, to Europe on mc.; 17–7–15, permitted to rejoin. 1819 to 1823, on Deccan svy.

PICKERSGILL, Joshua. Ben. Inf.
b. 11–5–1781. d. of fever, 8–9–18, Saugor, CP; MI.

Ens. 21–7–06 ... Lieut. 1–2–07.
Son of Joshua Pickersgill of St. Albans and Harriot his wife, dau. of Sir John Murray (1718–77), Bart., *DNB.*; bro. of Wm., Ben. Inf.
Author of *Three Brothers*, 4 vols. 1803. Crofton, II (63). Hodson, III (526).
30–6–04, purchased commn. as Ens. HM. 22nd Regt. (Cheshire); embarked for India Sept. 1804; joined 22nd Cawnpore, 24–6–05, remaining till 5–5–06, when granted leave[4].

DDn. 81 (14), Jan. 1808, survd. route of 1st 24th NI., Delhi to Agra.

Feb. 1813, owing to his experience of route svy. appd. to comd. escort of Maj. Bradshaw, investigating Nepalese encroachments on Gorakhpur frontier, [38]. Survd. lands under dispute towards Butwāl, continuing through "the heats of April and the rains of September" [5, 35][5].

BGO. 15–1–14, relieved of comd. of escort, and appd. to svy. whole length of Nepāl frontier with Gorakhpur, under SG.'s orders. Several times interrupted by Nepalese, he narrowly escaped fate of the police parties that were cut up towards the end of May [39–40, 312][6].

BSC. 10–1–15 (44), "Lieutenant Pickersgill, who had been so long employed on the Northern Frontier, and who has evinced the most active industry and zeal, and great intelligence in collecting and digesting topographical information regarding the frontier and the routes leading into Nepaul, [appd.] to the charge of the Guide and Intelligence Department, under the Quartermaster General with Major General Marley's Division".

Feb. 20th., was hero of a successful brush with the enemy [5, 41], Lt Col. Dick[7] writing, 21–2–15; "About ½ past 9 A.M. yesterday morning, a firing was heard...in the direction towards which I had instructed Lieutenant Pickersgill to make a reconnaissance". Dick moved forward with reinforcements, and "shortly afterwards we came in view of Lieut. P.'s party advantageously posted near a large tank; the Enemy were now moving down upon him, and he very judiciously ordered his small party of Infantry to retire slowly towards me, at the same time that the Cavalry moved out to the eastward in order to get into their rear, and, on

[1] MRIO. 81 (52–4). [2] Hilsa 72 G/7. [3] *Ben Regr.* 138 (35). [4] Affidavit re. age; BMC. 4–9–06 (41). [5] B Pol C. 29–10–13 (40). [6] Journal MRIO. M 326, 20/4 to 30/6, 1814. [7] George Dick (1764/5–1844); Ben. Inf.; Hodson II (55–6).

the discovery of our men advancing to his support, they became irresolute, and soon began to retrogade, on which they were charged repeatedly, and soon put to the route, and followed up by the Irregular Cavalry. ...

"The Judicious conduct of Lieut. P., when his small Escort was attacked, in keeping the Enemy in play till the arrival of reinforcements, and the Judgement he showed in encouraging them to venture to a distance from the Jungle and Forest are very creditable to the character of that active and indefatigable officer".

Pickersgill himself writes; "Having quitted camp early in the morning to make a reconnaissance in the direction of the Enemy's Post, ... I proceeded to the village of Dossouta, six miles in front, at which time my advanced party of Irregular Cavalry was fired on from the village of Peirarce, nearly two miles distant on the road I was pursuing. ... The Irregular Cavalry were led by Cornet Hearsey[1]". After firing the village, Pickersgill concealed the Cavalry in the tank, and then withdrew his "feeble escort of twenty firelocks", whilst the cavalry "was most seasonably led out by Cornet Hearsey, and conducted to a point between the village and the Tank". He had not forgotten to send a message back to camp, which brought the reinforcements under Lt Col. Dick[2].

BMC. 9–6–15 (53–4), granted sick leave to Mauritius & the Cape; on his return resumed duty on Nepāl frontier, with post of AQMG. Nov. 1815, submits reports of "reconnaissance from the top of the Sumsawar Mountains, and the various routes into Nepāl"[3], and in Feb. 1816, his active work led to the successful advance of the 3rd Bde., of Ochterlony's victorious force, "through an intricate and difficult pass over the hills" he had discovered[4].

"The force reached Mukwanpoor[5] on 27th February. On 28th a force was sent to seize a village...just evacuated by the Goorkhas. Captain Pickersgill accompanied them, and was proceeding to occupy some other points along the ridge, when he perceived a large force of the enemy ascending the northern side of the hill so as to cut him off. He made good his retreat down the Southern declivity, and reported the situation to Headquarters, where action was taken to sieze the opportunity to inflict a striking defeat of the Goorkhas, which spread consternation at Khatmandoo [43, 366]"[6].

BMC. 6–9–16 (164 *et seq*), granted permission to examine official documents in various Govt. Depts. to assist compilation of an account of Nepāl War.

1816–7, on svy. of boundary between Nepāl and Sāran Dist.

Marātha War; DAQMG. 1st. cl. 1–1–17; with Left Div. of Grand Army; AQMG.; March 1818, made sketch of Dhamoni at its siege and capture. Mandala, 26–4–18; "After several hours battering, Lieutenant Pickersgill, with great gallantry, proceeded to ascertain by personal inspection the effect produced, mounting, with the assistance of his hircarrahs, to the top of the breach, from which, after making his observations, he returned with so favourable a report as induced General Marshall to make immediate preparations for storming the works".

After his death, James Franklin obtained permission "to arrange the materials of the late Lieutenant Pickersgill, and to subscribe his name to them, as a mark of respect to the memory of a most able and zealous officer of the Quartermaster General's Department"[7].

PIERCE, Fortunatus Hagley. Bo. Art.
bapt. 3–6–1784. d. 31–12–32, Bombay.

Lt Fwkr. 15–5–02 ... Col. 5–6–29.

Son of Thos. & Liddy Pierce, of Bristol; bro. of Thomas [*inf*].

m., 1st., Bombay, 13–2–16, Miss Harriet Calland Hawkins, who d. 8–6–18, at Seroor.

m., 2nd., 18–5–21, Miss Caroline Frances West.

DDn. 278 (29, 112), 1807–8, survd. Maj. Walker's route from Baroda to Porbandar, Kathiawar; 1809, survd. route, Halwāna to Khambhaliya; both embodied in Hardy's map [169], and classed later by Jopp as "valuable".

PIERCE, Thomas. Bo. Inf.
bapt. 2–5–1782. d. 22–12–32.

Lieut. 26–5–1800 ... Lt Col. 2–2–26; ret. 24–5–29.

Bro. of Fortunatus Hagley [*sup*].

m., 5–5–23, Louisa, widow of Capt. Stephen Ford, W. Middlesex Mil.

EIMC.

CD. to Bo. 27–6–10, Directors fail to receive Pierce's map of Kanara forests, copy of which he took home for them [168].

POOLE, Henry Wynne. Mad. Inf.
b. 29–8–1786. d. 16–3–44.

Ens. 20–5–08 ... Maj. 31–8–34; ret. 2–10–35.

Son of John & Mary Poole, of Manchester.

m., Cheltenham, 2–10– 1, Marianne, widow of Rev. J. Mears.

Oriental Club.

July 1812, MMI., cl. VI [321]; MGO. 15–7–14, appd. Asst. in QMG.'s Dept., svy. branch [322]; ib. 21–1–15, promoted to 1st cl.; on svy. in Berār.

POTTINGER, Henry. Bo. Inf.
b. 3–10–1789. d. 18–3–56, Malta.

Ens. 18–9–06 ... Bt. Col. 22–1–34; Lt Gen. 1851.

Son of Eldred Curwen Pottinger; uncle of Eldred Pottinger (1811–43), Bo. Art., *DNB.*

m., 9–9–20, Susanna Maria, dau. of Capt. Richard Cooke, of Dublin.

ed. Belfast. Bart. 1840; GCB. 1842.

DNB.; DIB.; Oriental Club; Davis (18–9). Portrait by Grant at Oriental Club; engraved copies IO. and VM. (Foster 96).

1809, with Hankey Smith's mission to Sind [168–9].

Jan. 1810, under Malcolm's direction [7, 174–5], sailed with Christie from Bombay, landing W. of Karāchi, and travelled in disguise thro' Baluchistān to join Malcolm in Persia [385]. They were forced, he writes, "after landing, gradually to lay aside the few necessaries that we had taken from Bombay; ... to live in a state of the most abject Poverty and Privation was indispensably requisite. ...

"At the time I separated from Captain Christie at Nooshky[8] the whole of my cloaths consisted of one Shirt and Pair of Trousers of coarse white cloth which, without having it in my power to change, I was obliged to wear, exposed to the greatest vicissitudes of climate and season, for nearly two months, during which time I slept but four or five nights in a House, or under a covering of any kind; that for upwards of three weeks of the same period, I and my men subsisted on one scanty meal per diem, of Barley, Bread, and Water, for which we were indebted to the precarious and charitable donations of the Natives we met with, from whom in my character of a Haji[9] I found it necessary to beg, it being totally impossible to procure food to purchase. My three camels, also, being deprived of their daily allowance of Barley Flour, became from constant travelling so thin and weak that at length I was forced to abandon one of them, and latterly to walk on foot (as well as my men) the greater part of each day's route".

[1] John Bennett H. (1793–1865), Ben. Cav.; half-bro. to Hyder Jung H. and sole legitimate son of Andrew Wilson H. [404]. [2] BSC. 7–3–15 (99). [3] ib. 20–1–16 (18). [4] *Nepaul Papers* (862); Cardew. [5] 72 E/3, 28 m. SW. of Kāthmandu. [6] Prinsep, I (203). [7] DDn. 191 (351), 16–8–21. [8] Nushki, 34 K/2, 75 m. SW. of Quetta. [9] Muhammadan who has made or started on pilgrimage to Mecca.

On account "of the extraordinary hardships and great personal dangers" to which he and Christie had been exposed, Govt. granted them each a donation of Rs. 5,000 in addition to official allces[1]. [339].

Pubd. account of these journeys in 1816, *Travels in Beloochistan and Sinde, etc.*

Had distinguished pol. career ; Resdt. Cutch, 1825 ; PA., Sind, 1836 ; mission to China, 1840 ; Govr. Hongkong, 1843–4 ; Govr., Cape of Good Hope, 1846–7 ; Govr., Madras, 1847–54.

PRICE, Ferdinand. Bo. Engrs.
b. 2–3–1791, Guernsey. kd. in action 11–11–20, Alashkara, Arabia.

Ens. 18–9–08 ... Lieut. 1–1–10.

Son of Wm. Peter Price.

Bo RC. 27–4–14, appd. to rev. svy. ; Bo MC., 11–2–15, Senr. Asst. rev. svy. Bombay I. [187] ; ib. 18–10–15, to Surat under CE.

RAND, Charles. Mad. Inf.
b. 10–8–1778. d. 21–8–08, Bangalore.

Ens. 18–1–1796 ... Capt. 21–9–1804.

m., Madras, 28–3–03, Eliza Jackson, dau. of MGen. Collins.

1801, Sketch of Wynād[2], sd. as "late Depy. Capt. of Guides"; 1802, Maps of Kurrungutta and "Cotiote"[3] [123].

DDn. 43 (241), 1–7–06, Mackenzie addresses him as Town Major, Seringapatam.

Not to be confused with Chas. Rand. Mad. Inf., Ens. 22–10–1782, Capt. 12–10–1798, ret. 1802.

RANKIN[4], John Grant. Ben. Inf.
b. 26–7–1789. d. 6–8–12.

Ens. 30–4–05 ... Capt. 12–10 1798 ; ret. 1802.

Son of Charles Ranken, Ben. Inf. [I, 368] and Mary his wife.

ed. Charterhouse, 1801–3. Hodson, III.

May 1809, submitted svy. of route marched by Rāmgarh Batt.[5] [44], on which SG. reports, 18–11–09, "that the Surveys & Routes, ... together with two new maps drawn by him contain much new and very useful information, such as clearly entitles him to receive the allowance of One Hundred Rupees per month. I consider this officer's labour so valuable as to induce me to mention his name in the Public Report of Work done in the Department"[6].

BGO. 7–11–09, leave "to St. Helena or Cape of Good Hope, and eventually to Europe for the good of his health".

RAPER, Felix Vincent. Ben. Inf.
b. 1778, Macao, China. d. 14–11–49.

Ens. 29–9–1797 ... Col. 1–12–29 ; MGen. 1838.

m., Fategarh, 5–5–20, Eliza, dau. of Lt Col. Chas. Fraser, Ben. Inf.

Hodson, III (611).

March 1808, at Rewāri with 10th NI.[7], permitted to join Webb's expn. to explore sources of Ganges. Kept journal of expn. which failed to reach Gangotri, but reached Badrīnāth at head of E. branch [74–6, 80]. His account was pubd. in *Asiatic Researches* [76].

1808–9, attd. to escort with Elphinstone's mission to Peshāwar which left Delhi Oct. 1808, and asstd. Macartney with map of Afghānistan [66, 271].

Webb tried to get him for another expn. into the mountains, which, however, failed to come off [79] ; "Captain Raper is now on his return from Peshāwar and, if I can prevail upon him to be again my fellow Traveller, his superior abilities, as well as our long acquaintance and friendship, will render me most happy in his Company. It must be admitted, however, that the last journey holds out no particular encouragement, for though I managed so as to defray his (and also Captain Hearsey's) travelling expenses, he is still a considerable loser on account of baggage and books he was obliged to leave behind. The continuance of my employment has of course amply recompensed my own losses"[8] [33].

Jan. 1810, allowed Rs. 100 a month, "with an Establishment of one Tindal and 10 lascars...to make the requisite surveys of the cantonments of the Delhi and Rewāri command" [61][9].

BGO. 16–10–13, appd. to relieve Smyth "from the duty of the Survey of the Southern and Western Frontiers of Behar & Bengal", and survd. SW. borders of Chota Nāgpur and Gāngpur, and part of Rānchi plateau [6, 46–7, 230, 312, 366] ; maps very neat and clear ; indicate a point on Sank R. "diamonds from here" [I, 20, pl. 13].

Nepāl War, 1814–5 ; with Commy. Gen's Dept., and held ch. of Guides & Intelligence Dept. with force in Kumaun ; auth. of *Report* on Kumaun[10].

9–11–16, appd. 2nd. Asst. to Resdt. at Lucknow, and spent the rest of his service in Pol. Dept.

RAVENSHAW, William. Mad. Engrs.
bapt. 21–2–1781. d. 5–1–25, on board ship in Madras Roads.

Ens. 30–1–1796 ... Capt. 15–11–10.

Son of J. G. Ravenshaw of Easthampstead, Berks., and Elizabeth, dau. of Col. Withers.

1803, on service in Cuttack ; survd. marches of Col. Cuppage's force.

MMC. 2–7–05, appd. to succ. Arthur on Mysore svy. [380], but did not join ; MMC. 14–1–07, appd. to succ. Blair on svy. of Travancore [131], but asked to be relieved two months later.

DDn. 151 (64), Riddell, 15–10–17, proposed to purchase for Govt. a theodolite, chain, and levelling inst., the property of Ravenshaw, for £ 200. The theodolite was of the same pattern as Lambton's, but about half the size.

1822, made "Plan of the Town of Madras and its limits... for the use of the Justices in Sessions"[11].

REMON, Thomas. Bo. Engrs.
bapt. 22–12–1790, Jersey. d. 5–11–25, Mandvi, Cutch.

Lieut. 1–10–08 ; Capt. 16–8–19.

Son of James Remon.

Bo RC. 7–10–12, appd. Asst. to Rev. Survr. [187, 323].

Sept. 1814, warned for field service ; Bo MC. 19–2–15, being Engr. officer with dett. in Gujarāt, directed to svy. the country, but without appt. or allces. of survr. ; survd. part of Gujarāt and Cutch during 1815–6.

REYNOLDS, Charles [I, 378–80]. Bo. Inf.
b. 1756/7. d. 24–6–19.

Ens. 20–7–1775 ... Lt Gen. 4–6–14 ; resd. 2–3–07.

SG. Bombay, 1796–1807.

Possibly son of Wm. Reynolds, baker, Bloomsbury, adm. St. Paul's School, 7–4–1769, aged 12. Bro. to Wm. Reynolds, attorney of Folkestone, whose 3rd son Wm., Bo. Inf., was on Gujarāt Rev. Svy. 1820–4.

Arrd. India 1772, as cadet, aged about 14, and served in Marātha Wars till 1782, making route svys. ; 1782–3, with Mathews to Bednur, survg. part of Kanara ; 1785, survd. route from Surat thro' Mālwa to Gwalior and, 1786–90, made numerous

[1] B Pol C. 25–6–12 (9, 10). [2] 49 M/14 & 57 A/2. [3] Kottayam, 49 M/9. [4] As spelt in Bengal records ; his father spelt name Ranken. [5] *Ben Regr.* 120 (8). [6] DDn. 81 (162). [7] same batt. as W. S. Webb. [8] DDn. 82 (186), July 1809. [9] Progs. of VP in C. 16–1–10 [10] *Nepaul Papers* (143–52). [11] *As J.* XVIII Aug. 1824 (145).

svys. thro' Deccan under direction of Resdt. at Poona [I, 125–8].

April 1790, Mysore War, to Malabar, making various svys. [I, 128], concluding, 1792, with svy. from Hyderābād to Agra ; 1793–4, svy. of upper *doāb* to Delhi and return to Lucknow [I, 132 ; II, 383, 389 n.8].

1795 to 1807, employed, mostly at Surat, on an immense map of W. India, scale 18 inches to a degree, later reduced to half, compiled from his own svys. and those of a number of Indian survrs. trained by himself [7, 8, 62, 165, 227, 279, 282–3, 286, 298] ; on leaving India provided pensions for these survrs. [I, 288–9 ; II, 353]. From 1801 had a small body of assts., one of whom, Williams, succ. as SG. Bombay [305–6, 323, 337].

Sailed from Bombay, 2–3–07, taking copy of his map for Directors [171]. Married and settled in Portland Place, London. Died at Cheltenham, aged 63 ; MI. in St. John's Ch., St. John's Wood Rd. ; portrait by Raeburn, I, pl. 20 ; by John Smart, 1810.

RIDDELL, John. Mad. Inf.

b. 3–5–1785. d. 1–9–18, Madras.

Lieut. 17–7–05.

Son of John Riddell, merch., some time Provost of Glasgow.

ed. Glasgow Grammar School and Univ. ; matric. 1797.

April 1806, MMI., cl. II [320, 320] ; Dec. 1808, appd. to Lambton's svy. of S. peninsula [242–3], and employed on 2ndy. trgn. and topo. sketches, Trichinopoly & Dindigul to Cape Comorin. Feb. 1809, on mil. duty with St. Leger's dett. in operations in Travancore [244] ; employed on svy. in Travancore under Arthur [132], rejoining Lambton, May 1809. After detail svy. in Tinnevelly, Madura, and Pudukottai, joined Lambton at Pondicherry, 1810, "to assist in combining the whole of their labours" [243–4].

Specially permitted to remain on Lambton's svy. ; spent 1811 on trgn., with asstce. of Peter Lawrence, of great arc Paughur to Kistna R., and longl. series from Bellary to E. coast [4, 245–6, 371] ; to Lambton's great regret had to revert to unit Dec. 1811 [246, 263, 322–3].

16–11–13, appd. temporary asst. at MMI. field season 1813–4, after which appd. AQMG. svy. branch 2nd class [322].

ROBERTS, Henry Tufnell. Ben. Cav.

b. 30–7–1785. d. 3–2–59.

Corn. 8–11–1799 ... Col. 19–9–38 ; furl. 8–5–39 ; Lt Gen. 11–11–51.

Son of William Roberts (1746–1809) Ben. Inf., and Elizabeth his wife ; bro. of C. M. Roberts [1781–1845] Ben Cav.

m., Lymington, 17–6–23, Jane, dau. of Thos. Beckley, of Lymington ; she d. 16–7–90, aged 89. CB. 1831.

EIMC. II (430–8) ; Hodson, III (666–7).

On service in Baghelkhand 1803 ; occupation of Bundelkhand 1803–4.

1806–7, survd. route from Hazāribāgh to Nāgpur and back whilst comdg. escort of Richd. Jenkins, Resdt.-designate of Nāgpur [52–3, 198 n.3].

ROBERTSON, James. Ben. Engrs.

b. *c.* 1775. d. 4–11–10, on board *budgerow* at Ghāzipur ; MI.

Ens. 19–8–1793 ... Capt. 8–10–06.

Son of Charles & Margaret Robertson of Edinburgh.

m., Chinsura, 13–2–03, runaway match, Sarah Anne Catherine, dau. of Thos. Whinyates, Ben. Inf. ; she re-m., Calcutta, 8–6–11, Robt. Younghusband (1785–1853), Capt. 53rd Foot, and was celebrated later at St. Helena for "her venemous tongue" ; *v. A St. Helena Who's Who*, by Arnold Chaplin, 2nd edn. 1919.

Hodson, III (672–3).

17–8–1792, arrd. India, cadet ; BGO. 29–7–1793, warned for mil. service on coast, probably siege of Pondicherry.

1804–5, on svy. of Barrackpore cant. [18] ; on levelling svy. for drainage of Calcutta, and as dmn. in CE.'s office [17] ; March 1805, to join army in field.

ROBERTSON, Thomas [I, 382]. Ben. Engrs.

b. 1762–3. d. 18–6–31, Calcutta ; MI. S. Park St. cem.

Ens. 17–7–1772 ... Col. 5–6–29.

m., 1st., 4–11–99, Edinburgh, a dau. of Wm. Hamilton ; she d. at sea, July 1807 ; his 2nd. wife d., Selkirk Manse, 18–11–22.

Hodson, III (676).

On svy. of Calcutta, 1782–4 [52–3] ; 1794, on svy. in Chittagong Dist. [59].

BMC. 11–12–02, appd. to svy. Sundarbans and Salt Dists., through Lakshmīpur to Chittagong [6, 13–4, 15, 20, 22] ; DDn. 67 (316), SG. regrets, 24–4–04, to learn of "disaster you had met with off the Island of Sundeepa".

1804–5, Marātha War, survd. marches of the Grand Army between Muttra and Hingonah [57, 309]. BGO. 20–3–06, appd. Engr. & Survr. at PWI.

1824 Garr. Engr. & Ex. Offr. Chunār.

ROCHFORT, William Henry. Bo. Art.

b. 11–9–1795.

Lieut. Fwkr. 25–10–11 ... Lieut. 2–2–16; resd. 6–12–16.

Son of Wm. Rochfort, of Maplestead, Essex, and Elizabeth Sperling.

ed. Addiscombe.

Bo RC. 29–9–13 ; "Has been instructed in the duties of a surveyor in England, and is understood to be fully qualified in that branch of the Military profession" ; appd. from "the Battalion of Artillery to be an Assistant to the Surveyor General, with an allowance of 120 rupees per mensem".

2–2–14, on SG.'s est. as asst. (temporary) on svy. of Broach [323], but omitted 11–2–15.

ROGERS, Charles. Ben. Inf.

b. 16–1–1788. d. 19–8–61.

Ens. 4–11–07 ... Maj. 8–2–41 ; ret. 14–3–43 ; Hon. Lt Col. 28–11–54.

Son of Sarah Rogers.

m., Shāhjahanpur, 3–2–17, Charlotte, dau. of Alex. Wright, BCS. ; she d., Hazāribāgh, 1–11–17, aged 23.

Hodson, III (686).

1812, survd. routes of Rāmgarh Batt. in Chota Nāgpur [47, 312] ; BGO. 11–9–13, "to proceed to sea for the benefit of his health".

ROUGHSEDGE, Edward. Ben. Inf.

b. 21–8–1774. d., unm., 13–1–22, Sonpur near Sambalpur ; MI.[1]

Ens. 17–11–1795 ... Maj. 6–4–18.

Son of Rev. Robert H. Roughsedge, rector of Liverpool, and Elizabeth his wife.

Hodson, III (700–1).

Adjt. Rāmgarh Batt. 1804; Comdt. from 1806 [46, 47]; PA., Sambalpur, 1819 till death. 1822, AGG.
Occasional svys. of marches of Rāmgarh Batt. [47].

SACKVILLE, Frederick. Ben. Inf.
b. 5–12–1785. d. 19–10–27.

Ens. 1–9–01[1] ... Lt Col. 27–1–26; furl. 1827 till death.

ed. RN. Coll. Portsmouth.
m., before Oct. 1808 [*inf*].
EIMC. I (372–3); *Oriental Club;* Hodson, IV (1).

From 1803, on service in Bundelkhand; Sept. 1804, Asst. Survr. with Martindell's force [310, 358]; May 1805, appd. Survr. under orders of SG. [199–200, 221–2, 288, 309–10], and by 1809 had completed svy. of all areas then accessible with mil. protection [5–6, 48–9, 51, 309].

Oct. 1809, started svy. of Orissa under SG.'s orders, receiving special instns. for locating line of new road through Cuttack [5, 24–5, 192–3, 312, 365, 383]. DDn. 82 (188), writes to SG., 16–6–10, "There formerly has been a well-raised road through this province, and which has fallen to decay, and gradually disappeared, in consequence of the inattention or inability of the Mahratta Government. This supposition is strongly corroborated by the remains of several bridges at present generally in ruins, and which must have been formerly built not only on a substantial, but also on a large and expensive, scale. ...

"It appears...that a good road did formerly exist...and nearly in the same direction as the present which, leading through the principal stations, ... of itself points out the most advantageous line of direction on which it should be formed. ...

"The average height of the road above the common level of the country should not be less than six feet, ... and it would be advisable for the first two or three wet seasons (from the 1st of June to the 1st of December) to prevent, by a public prohibition, any carriages passing over and injuring it".

Both the svy. and the road were pet projects of Garstin, who at this time doubled the jobs of CE. and SG. [295]; he submitted, 11–11–11[2], "the report on the subject of the Road which it is proposed to make from Calcutta to the Pagoda of Jaggarnaut thro' the Province of Cuttack. ... I am in expectation of soon receiving Lieutenant Sackville's Survey, which will enable me to make a much more correct estimate [401]. ...

"Frequent complaints have been made that the new road to Benares[3] is too narrow for the march of an army, particularly if accompanied with artillery, its breadth being only 16 feet. To avoid this great evil, I would make that now to be constructed, generally speaking, twenty-one feet in width on the top, and thirty-two at bottom. ... It does not appear to me to be necessary to cover the road with brick or stone; at any rate it will be prudent to let the Earth thrown up settle for one or two rainy seasons. ... This is certainly an expensive road, but the country will be for ever secured from the floods, and the road at all seasons be free from interruption".

On conclusion of his svy., Sackville was appd., BGO. 21–3–12, to supd., the construction, continuing till his resn., 1–1–18.

1–1–17, appd. AQMG. on svy. est.; May 1818, AQMG. with Martindell's force; furl. 24–2–20 till 1823; 1824–5, Agent for Army Clothing; furl. 1827 till death.

DDn. 81 (213), Garstin writes, 5–10–08, "Make my best remembrance to Mrs. Sackville"; this is the only evidence found of his marriage.

His will contains the following curious provision; "Frederick Sackville, late of Richmond, Surrey; to be buried at the Parish of Winbaston, in the city of Bath, within the same vault, and next to the tomb of, the Revd. Thomas Leman[4], late of Bath, to whom I have been united by gratitude and affection through life; and with whom I wish my spirit to continue, though in death". Legacy to the Upper Orphanage School in Calcutta, and to various friends and charities[5].

SANDYS, Henry Capel. Ben. Inf.
b. 27–12–1790. d. 19–3–73.

Ens. 18–7–07 ... Maj. 9–5–30; ret. 6–11–32; Hon. Lt Col. 28–11–54.

Son of Rev. Michæl Sandys and Barbara his wife.
m., Cæn, Normandy, 5–8–22, Harriet, widow of Hugh Spottiswode, MCS.
Hodson, IV (18).
BGO. 30–1–13, to svy. embankments in Cuttack Dist.; BMC. 14–1–15, to rejoin his corps in the field.
BGO. 22–1–16, to assume temporary ch. of construction of road to Puri, owing to Sackville's ill-health [*sup*].
ib. 29–11–16, to be DAQMG.; 14–11–17, in ch. of Guides & Intelligence Dept. Nāgpur Subsy. Force; 24–10–18, Bde. Maj. Nāgpur Rāja's Inf.; remaining in Nāgpur service till 1830.

SCHALCH, John Augustus. Ben. Inf.
b. 27–11–1793. d. 25–2–25 of wound received in action, 23–2–25, Kiungpala, Arakan.

Ens. 22–2–09 ... Bt. Capt.; "official" Major 16–9–24[6].

Son of Andrew Schalch, Capt. RA., of German-Swiss extraction from Schaffhausen, Switz., who was nephew of Andrew Schalch (1692–1776), master-founder at Woolwich Arsenal (*DNB.*); bro. of Philip Schalch, Ben. Inf.
ed. RMC. Great Marlow 4–8–07 to 29–8–08.
Hodson, IV (26).

Before June 1813, survd. Etāwah cant. [28].
BGO. 24–7–13, from 14th NI. at Gorakhpur, appd. asst. to George Fleming on svy. of city of Murshidābād [18], SG. writing, 6–8–13, "I have been lucky enough to get you appointed as an assistant Surveyor to Colonel Fleming. ... The moment you get the General Order, you must hasten down to him, and put yourself under his orders. I am very well convinced that in your attention and assiduity you will support the character I have given of you to Government"[7].

Fleming wrote of this to the SG., 7–8–13; "By mere accident (having gone into Cantts. to see HE. the C-in-C.) I heard of his appt. I hope that he knows something of the business and, not like a Gentmn. lately appointed to a Survey, *totally* ignorant of everything about it. I cannot help thinking it uncomfortable having a perfect stranger thus given to me as an Assistant, but it does not signify if he knows his Duty. I shall endeavour to make things as comfortable for him as I can, but if he does not understand the Work, I shall be obliged officially to say so"[8].

Schalch was, however, a great success, and Fleming writes, 11–9–13; "My Dear Charles, I have great Pleasure in informing you...*our* Friend Mr. Schalch arrived here on Monday Morng. I really think you might Pick and Choose out of any Thousand Men (Old and young) in the Service, and could not have lighted on one that from all appearance would, or could, have been more agreeable, not only to *me* in a Public point of View, but to *us* as an inmate of our Family; you know him, I need not therefore take up your time further on the subject than to thank you for having sent up such a nice young man [311–2, 397].

[1] date as given by *EIMC.*; 13–11–01 elsewhere. [2] DDn. 128 (48). [3] Survd. by Ranken 1782–4 [I, 368]. [4] not identified. [5] Bengal Wills, 1828. [6] BGO. 16–9–24. [7] DDn. 135 (11). [8] DDn. 130 (41).

"I am truly sorry tho' to tell you that I fear his constitution is not quite up to His inclinations. He looks very poorly indeed, poor fellow, but I trust He will pick with us, for I certainly will not work Him hard. He has got a very nice Theodolite with him, I will not therefore trouble you to get me one from the Arsenal. However I will thank you to let me know what is the Honble. Compy.'s Price for their Theodolites" [221–4][1].

Schalch was an enthusiastic astronomer; he writes, 17–4–14, to Crawford who was holding courses for young officers at Calcutta [193]; "I send the work of my leisure evenings ; as I have a pretty good Telescope, & can get the loan of a very capital chronometer, I am looking out anxiously for the eclipse, to get the longitude of Berhampore". After asking for Crawford's advice, he continues, "and if a person at a different place from yours will be of any assistance to you, that you will make use of me, tho' I do not think my observations will be of much service ; I have a great wish to become a bit of an astronomer, but without assistance it is very difficult. I have had a great help from the sextant that Colonel Fleming gave me. ...

"I have for these some days been very unwell from a hurt I received on Horseback, but have now got round again".

As the Murshidābād svy. neared completion, Schalch was recdd. as asst. on the Sundarbans svy., and Fleming writes, 6–5–14, "My very good and much esteemed young friend Schalch is delighted, and indeed so am I, at the prospect of becoming Dy. QMG., Assistant to Mr. Morrieson in the Survey of the Sundarbans.

"He is now working hard to finish my plan for me. ... Mr. Morrieson will have a treasure in him, & he can correct all their work by celestial obsns. He is already known to Mr. M., else I would thro' you recommend him in the strongest manner as being one of the best tempered, good natured, young men I have had the happiness of knowing, and withal ...fond of, and indefatigably attentive to, his duty"[2].

Schalch spent the rains at Calcutta, and Crawford writes, 17–8–14, "Ensign Schalch...is now studying under me, and I must allow him to be a most Superior young man ; and of all young men the one that Lieut. Morrieson would be most happy to have"[3].

BGO. 10–9–14, appd. asst., to Morrieson on Sundarbans svy. [17 n.2, 432]; BGO. 23–12–14, to relinquish svy. and join corps ; and later "to proceed to Gen. Wood's Division of the Army" [40]. DDn. 131 (150), 20–6–15, SG. acknowledges Schalch's fdbks. of May 1815, "with a map of all General Wood's marches in Goruckpore"[4].

DDn. 147 (104), 28–12–15, Crawford writes to Mackenzie, that Morrieson "had with him...a young officer of very promising abilities, both as an astronomer as well as a mathematician, of the name of Schalch (pronounced Shock)...who would prove most beneficial...as an assistant, should his Lordship think proper to have the Survey of the Sundarbans carried on".

Of Schalch's later work the most important was the lay-out of Calcutta canals.

SCOTT, William. Asst. Survr., Madras.
b. *c.* 1786. d. May 1827.

Appce. 1–9–1798.
m., Madras 21–11–10, Miss Jane Sheppard.

At Obsy. survg. school 1798 to March 1801, when he joined Warren on Mysore svy. and continued with him on tr. to Lambton's svy. and later to the Obsy. [451]. Warren writes, 30–11–10 ; "Mr. Scott was first placed under me...when a mere boy ; his education was then far from advanced, but he evinced that degree of application and steadiness which greatly facilitated the improvement of his Talents".

1805–6, with Warren on svy. of Coringa and Vizagapatam [159].

1807–10, Usher at survg. school ; "He has every year been detached with the apprentices on practical surveys in the vicinity of Madras" [142, 163–4, 341]. Reported by Warren, 30–11–10, as "fit for any situation in his profession which requires trust, honesty, and application"[5] [347].

May 1811, Warren made a very different report, accusing Scott of a multitude of misdemeanours, and of "idling away his time in dissipation and arrogant, assumed, importance", and lamenting having to make such a report on "a young man I had educated from a child, and whom I may well term 'a snake I have warmed in my bosom' "[6].

This change of tone followed the appt. of Mackenzie as SG. ; the school had been tr. to his control, and Warren's duties confined to those of Astronomer ; the number of pupils had dropped to six, and no doubt Scott had not sufficient work. The consequences of this feud between them were, however, most unfortunate for Warren, for Scott retorted by drawing attention of Govt. to the financial profit that had been made by Warren for several years in the admn. of the school accounts and est. [348 n.7], all quite in accordance with the generally accepted customs of the age. Warren was called on to refund to Govt. the sum of 3860 *ps*.

From 1812, employed in SG.'s drawing office at Madras till in 1815 sent in ch. of a small party of young survrs. to svy. the Circārs ; 1818, joined Mackenzie in Bengal [352].

SEALY, Benjamin William Dowden. Bo. Inf.
b. 1783. d. 21–6–49.

Lieut. 14–1–1799 ... Lt Gen. 9–1–46.
Bro. to John B. Sealy [*inf*], who refers in his will to his "brother Ben".
m., 1820, Mary Ann Byers, probably sister to James Broff Byers [384], his fellow survr. of 1804–5.
June 1804 to Dec. 1805, with Bombay dett. from Gujarāt to Rājputāna, taking part in campaign against Holkar, and returning with svys. of all the marches, made in partnership with Byers [54, 165–6, 384]. CD. to Bo. 17–1–10, allowed Rs. 1,000 for the map prepared from these svys.
1812, granted survr.'s allces. whilst making route svys. from Poona.

SEALY, John Bellett. Ben. Inf.
b. 10–12–1780. d. 2–6–16, Barrackpore ; MI. in old cem.

Ens. 11–10–1797 ... Maj. 8–4–16.
Son of Benjamin & Elizabeth Sealy ; bro. of Benjamin [*sup*]. Hodson, IV (47).

1804–5, survd. marches of dett. under Lt Col. Broughton from Hazāribāgh to Sambalpur, and return by different route [44] ; survd. part of Māhānadi R. towards Cuttack, and reported existence of teak forests [23, 24] ; decorated some of his maps with artistic watercolour headpieces[7].

[1] ib. (69). [2] MRIO. M 575. [3] DDn. 131 (98). [4] Map, MRIO. 32 (72). [5] M Rev Bd. 10–12–10. [6] MMC. 28–5–11. [7] MRIO. 60 (12–14).

Will, dated 31–1–16, left "to brother Ben a case of silver Mathematical instruments. ... Rest of property to my mother. ... Brother Ben to be guardian of my natural daughter. ... A few memorials to my dear Maria and other friends".

SINCLAIR, John. Mad. Inf.
d. 12–8–27, Bezwada[1] (?)

Ens. 7–3–09 ... Capt. 1–5–24.

Dec. 1809, MMI., cl. V. [321]; MRIO. M 146, Memoir of svy. by John Sinclair, in spring of 1811.

Date unkn., svy. of route from Masulipatam through Khammamett[2] by Lieut. Sinclair [134][3].

It was probably of John that Mackenzie writes to Mountford, 23–9–20, when discussing officers for Northern Circārs svy.; "A Lieut. Sinclair, now in Travancore, executed some surveys on that frontier, and described that country. He is not a fine draughtsman, but you cannot always command such; but perhaps you know him; he seemed to me sufficiently adapted to such a survey"[4].

15th NI. 1810–2. Capt. 29th NI. & Comdt. 1st Batt. Pioneers at death.

SINCLAIR, Charles, Mad. Inf.
d. Nov. 1852.

Ens. 27–5–10 ... Capt. 8–9–26 ... Lt Col. ret. 31–1–47.

Son of Sergt. Maj. Sinclair of HM. 71st Foot.

m., 4–12–24, Miss Sarah Balfour, who d., India, 10–5–29, aged 20.

MGO. 10–3–12, to join MMI. 1–7–12, but actually joined cl. VIII on 1–7–14 [321].

SMITH, Robert. Ben. Engrs.
bapt. 13–9–1787, Nancy, France.
d. 16–9–73.

Ens. 29–4–05 ... Lt Col. 25–6–30; ret. 10–7–32; Hon. Col. 28–11–54.

Son of James Smith, lawyer, of Bideford, Devon, & Mary his wife; bro. of E. J. Smith, Ben. Inf. [231].

CB. 26–9–31. Hodson, IV (133–4).

27–6–05, tr. from Inf. to Engrs.

1807–8, Supdt. Works, gun-carriage agency; Adjt. Engrs. 1809–16; BMC. 22–1–08 (47) & 1–8–08 (25), appd. to construct lighthouse at Kijri [15]; 1–4–09, granted further advance Rs. 10,000 for lighthouse.

BPC. 2–2–10 (4), instructed by CE. "to survey the Dawk road from opposite Diamond Harbour to Kedgree, in order to...render it passable in the rains"; ib. 2–3–10 (7), reports that "Light House at Kedgree will be ready to display a light by the 1st of March" [401, 419].

15–9–10, appd. Fd Engr. with Bengal force proceeding to Mauritius [320]; 1811, senr. engr. on that island [348].

B Pol C. 13–12–11 (33), to move from Calcutta to Allahābād.

DDn. 126 (134), 9–4–12, SG. reports him "well qualified to conduct any survey. This officer who is just returned from the Isle of France is by far the best draughtsman I am acquainted with. His masterly rapid pencil particularly qualifies him for survey of the Frontier, as he will be able to delineate the passes and surrounding country with the greatest correctness".

Attd. to camp of C-in-C., Sir George Nugent, on tour of Upper India. Lady Nugent writes, 16–9–12, "Approaching Cawnpore. Received a present from Mr. Smith, an Engineer ADC.; He draws beautifully, and his sketches are all so correct that I know every place immediately. ...

"Dec. 2nd. 1812, Muttra. I took the Engineer officer, Mr. Smith, with me [on elephant], and we projected a drawing of the line of march which will be a treasure to me if he executes it according to my plan; and I have little doubt of its being quite perfect, by what I have seen of his drawings"[5].

BMC. 13–2–13, (5) appd. to relieve Crawford on svy. of S. frontier on latter's appt. as SG. [392]; survd. Singroula, S. Mirzāpur, Palamau, and border of Bundelkhand, continuing till 1814 [6, 47, 200 n.10, 231, 310–2, 409]. DDn. 131 (142), reproved by SG. for faulty fdbks., and delay in submission [220]. During rains of 1813 withdrew to Benares and Lucknow, probably to join his bro. [*sup*], and completed a magnificent map [47].

BGO. 5–6–15, drew Rs. 300 pm. as "Inspecting Engineer" whilst travelling "in attendance on the Rt. Hon. the C-in-C.", Lord Moira making a "military tour" in his role as C-in-C; [40 n.10].

During Nepāl War, 1815–6, Fd. Engr. with force in Kumaun, his appt. to PWI., ordered in BGO. 11–11–14, being postponed till 1816. 1820, pubd. a set of views of PWI.

Amongst later engr. duties, held ch. of repairs of Jumma Masjid at Delhi; survd. "works round the City of Delhi with surrounding country to 3600 feet"; scale 1000 ft. to an inch[6].

Leave to Cape on mc. from 8–2–30; furl. on mc. 26–11–30.

SMYTH, Henry William Carmichael. Ben. Engrs.
b. 30–7–1779.
d. 9–9–61; MI., Holy Trinity ch., Ayr.

Ens. 15–9–1794 ... Maj. 19–7–21; furl. 15–2–20; ret. 5–7–22.

Son of Dr. James Carmichael Smyth and Mary his wife; bro. to C. M. Carmichael, Ben. Inf. who dropped the Smyth from 1842.

David Scott, chairman to CD. writes to Alex. Kyd from London, 17–5–1800; "There is a son of Dr. Carmichael Smyth's in the Bengal Army. If he comes within your range, recollect that the father was my old College Mate, or rather School Mate, at St. Andrews, and since then in intimate Habits with me. A very able Physician, and what is of more consquence as good a fellow as lives. Write me about the son, who was our great favourite"[7].

m., Cawnpore, 13–3–17, Anne, dau. of J. H. Becher, widow of Richmond Thackeray (d. 1816), BCS., and mother of the novelist; she was b. 1791/2.

EIMC. II (337–40); Thackeray (30); *Addiscombe* (59): Hodson, IV (142–3);

Arrd. India 14–2–1797; to Penang with abortive expn. to Manila [I, 350, 412]; 1799, asst. Engr. under Kyd at Allāhābād [I, 346–7].

Early 1802, asst. survr. to Thos. Wood on W. boundary of Oudh, and on Wood's resn. appd. to svy. E. boundary [27, 34, 218 n.4, 268–9, 309, 327; pl. 6]. Broke off svy. in 1803 to join Lake's army, with which he survd. routes from Aligarh, 7–1–04, to Delhi, 21–1–04, and Muttra, 7–2–04, making very accurate svy. of "the high road from Delhi to Agra", besides many other svys [57, 59]. Present at capture of Dig and unsuccessful siege of Bharatpur [57], then becoming garr. engr. at Agra.

Possibly the painter of a fine coloured picture, MRIO. 83 (43), of Battle of Dig, 13–11–04, with account of engagement; all his svys. show him a fine dmn. and artist.

1807–10, furl. to England; 1811, with expn. to Java; 1812, Fd. Engr. at siege of Kālinjar [49 n.3]; BGO. 3–10–12, to svy. Mynpurrah I. at Palmyras Pt., preparatory to erection of lighthouse [24, 391][8].

[1] 65 D/10; D & M. reads "Buzuah". [2] 65 C/4. [3] DDn. 246 (140). [4] DDn. 149 (141). [5] Nugent (277, 395). [6] *Ben Regr.* 252 (79). [7] HMS. 729 (456). [8] Map MRIO. 106 (5); *Ben Regr.* 564 (212).

BGO. 26–11–12, appd. to svy. SW. borders of Chota Nāgpur, continuing Crawford's svy. from Palamau in SE. direction [6, 45, 311–2]. During April 1813 his party was overwhelmed by fever, and had to withdraw to Hazāribāgh for several months ; "from the unfortunate circumstance of my having been under the cruel necessity of putting a stop to active operations in the Field sooner than I should have wished, and which you are aware was owing to the dreadful sickness (I may indeed say pestilence) that raged throughout my small party [45–6, 359]"[1].

BGO. 12–6–12, appd. Ex. Engr. & Garr. Engr., Agra, but directed to complete his svy. before joining. Relieved from svy., 1–10–13, by Raper, and directed to "proceed by Dak and join Major General Marshall, either at Delhi or Rewarrie", to act as Fd. Engr. during operations against Alwar [398]. The small force accomplished its mission successfully, and returned to Rewāri early in December[2] [415].

Nepāl War, Fd Engr. to Gillespie's force, but not at Kalanga [90].

1822–4, Resdt. Supdt. at Addiscombe[3].

SOLOMON, John Collier. Bo. Engrs.
b. 20–8–1783, Halifax, Nova Scotia.
d. 29–6–13, Bombay.

Ens. 22–5–01 ; Lieut. 11–1–02 ; dismd. 31–5–13.

Before 1806, dmn. to CE. [170 n.6].

From 1805, and probably till 1812, employed "exploring large and unknown Woody Tracts" in Malabar on behalf of the Forest Committee [167].

STEELL[4], George. Ben. Engrs.
b. 20–8–1781. d. 18–5–40.

Ens. 28–5–1798[5] ... Capt. 4–10–08 ; furl. 25–7–13 till resd. 6–5–17.

Son of Robert & Mary Steell.

m., Ann—who d. 11–4–80, aged 70.

Oriental Club ; Hodson, IV (175).

1802–3, survd. cants. of Dacca & Chittagong [18] ; sold theodolite to James Franklin [231].

STEPHEN, William George. Ben. Engrs.
bapt. 17–7–1792.
d. 10–5–23, Puri, Orissa ; MI.

Ens. 25–3–09 ... Capt. 1–9–18.

Son of Dr. Wm. Stephen of West Indies, and Mary his wife : bro. to mother of Maj. W. S. R. Hodson, who raised Hodson's Horse.

m., Calcutta, 26–8–17, Esther, dau. of Rev. Thos. Truebody Thomason, of Calcutta, father of James, Lt Govr. of NWP. and founder of Engr. Coll., Roorkee [192 n.7].

ed. RMA.

Hodson, IV (178).

DDn. 126 (3), reported by SG., 24–3–10, as "well grounded in mathematics, and draws with freedom and taste" ; sent to Cuttack with Peckett for training in svy. under Sackville [25, 436]. They took lessons in astronomy under Mr. Thomason before they left [192] and Sackville reported, 12–4–11, that their progress in the fd. had been very satisfactory [383][6].

Stephen has left delightful samples of his work as artist in titlepieces on svys. of Chilka Lake, MRIO. 177 (5)[7], and Ganges R., MRIO. 168 (32) [pl. 18].

1811–4, on svy. of Benares area of Ganges–Jumna *doāb* [23, 35–6, 312, 365], and Engr. in ch. at Chunār till relieved by Wm. Morrieson, July 1814 [432]. Writes to SG., 7–10–14, "Both Morrieson & Myself are to go to Nepaul with Genl. Wood. ... I am sorry I have not got the whole of what I have surveyed put together into a map. During the time of my acting as Garrison Engineer at Chunār, I found my time fully occupied by the duties belonging to that situation, ... and was not able to attend at all to mapping".

Owing to delay in payment of his allces., Stephen was "obliged in order to take the field, to dispose of a capital Astronomical Telescope, and a good Chronometer, the former not long out from England. Morrieson has purchased both. He will be appointed Field Engineer, I suppose, and with his other staff allowances will be pretty well off"[8].

Nepāl War, Asst. Fd Engr. Benares Div. ; made occasional svys. in Gorakhpur *tarai*.

After close of the war, resumed svy. of Benares for two seasons. Amongst his later duties was the completion of the Cornwallis mausoleum at Ghāzipur [388, 432 ; pl. 18].

STEWART, Alexander. Mad. Inf.[9]
b. 17–8–1788. d. 4–5–24, Nāgpur.

Lieut. 17–7–05 ; Capt. 1–9–18.

Son of James Stewart, of Dublin, and Margaret his wife.

m., Cape of Good Hope, 17–4–19, Johanna Anna Eksteen.

April 1806, MMI., cl. II [320] ; 1808–10, on svy. of Travancore under Arthur [131 n.10] ; MGO. 17–11–08, to Bombay to join Malcolm's expn. to Persia ; spent several months mapping in Bombay, rejoining Travancore svy. April 1809[10] [132] ; ib. 9–10–10, to rejoin corps.

MGO. 5–4–11, appd. to Java expn. ; employed with Pioneers in Java, and attd. to HM. 68th Regt. ; ib. 5–1–13, appd. Asst. in QMG.'s Dept., svy. branch, 2nd cl. [254, 322].

1822 till death, ch. of svy. of Nāgpur.

SUTHERLAND, James. Bo. Inf.
b. *c.* 1784, Charleston, W. Virginia.
d. 15–5–50.

Lieut. 30–1–1798 ... Col. 5–6–29 ; MGen. 28–6–38.

Probably son of Capt. William Sutherland, Ens. Bo. Inf. 1775 ; HM. 53rd Ft., America 1777, and Capt. 55th Ft., America 1782—bro. to Milford Sutherland, "of H.M.'s military service"—nephew to James Sutherland[11] Commodore at Bombay 1798–1801 ; Master Attdt. 1802–5 [337]—cousin to James Cruikshank [393]

m., Bombay, 20–1–14, Maria, dau. of J. H. Cherry, Bo CS.

1810, cr. KLS., "Knight of the Lion and the Sun"[11], by Shah of Persia, being honoured with prefix "Sir", by many contemporary writers, and later works of reference[12] [444].

Oriental Club.

20–4–1798, appd. to Engrs., being one of "six Subalterns appointed to do duty in the Corps of Engineers, ... but continued on strength of Infantry Battalion. Want of Subalterns in the Infantry necessitated recall of Lieutenant Sutherland and 3 others[13] from the Engineers to join their Corps ; these officers at the same time foregoing their original idea of being ultimately removed to the Engineers [323, 456]"[14].

[1] DDn. 130 (29) ; 10–7–13. [2] BSC. 15–10–13 (16) & 10–12–13 (30). [3] Sandes, II (348). [4] sometimes Steel or Steele. [5] Conolly gives 25–4–1797. [6] Routes in Cuttack by Stephen, Dec. 1810–Jan. 1811, MRIO. 63 (21–2). [7] Survd. Jan. 1821. [8] DDn. 136, 575. [9] of 16th NI. ; another Alex. Stewart, Ens. 15–12–00, d. 10–6–20, belonged to 13th & 3rd Mad. NI. [10] Travancore map, 2 inches to a mile MRO. of 15th NI. ; Map 389. [11] Bo. Mar. ; 3rd. Lieut. 1770 ; Capt. 1785 ; ret. to England 1808. [12] Instituted in honour of Malcolm : Brydges (376). [13] One being Monier Williams. [14] Bo MC. 6–3–01.

Bo MC. 10–2–02, appd. 2nd Asst. in SG.'s office, to fill vacancy caused by Moncrieff's death, [283, 305, 337]; employed on Reynolds' map till 1808, being promoted to 1st Asst. in Jan. 1807 [323].

7–9–08, appd. Survr. with Harford Jones' (later known as Brydges) mission to Persia[1], embarking from Bombay 12–9–08, and carried out much valuable svy. during the two years that the mission remained in that country [7, 176, 280, 323, 339].

The following extracts taken from Brydges' *Account of his Majesty's Mission to the Court of Persia in the years 1807–11*[2] give many references to Sutherland and his svys., and the book contains a number of his crayon sketches of Persian figures.

After describing the ruins near Mardasht, Brydges continues, "Sir James Sutherland, by my desire, attempted to enter, and did enter, the opening which stands like a doorway about two thirds up the front of the superbly engraved mountain. ... To effect this was a matter which required great personal strength and agility; nor could it be done without considerable risk. ... Sir James was drawn up by ropes lowered from the top; and he reported that he found a room excavated in the rock, 29 feet long by 9 feet broad".

"On January 25th we reached Shoonastron, having stopped on the way to enable Sir James Sutherland and Mr. Morrier[3] to take an observation of the Sun's altitude". [Sutherland was frequently absent from mission hdqrs. on his svys].

After a hospitable reception at Tehran where several months were spent, the mission repaired to winter quarters at Tauris, Brydges writing; "To my excellent and ingenious friend, Sir James Sutherland, I have already acknowledged my obligations. ... At my request he was so good as to furnish the Prince Royal with the most beautiful models, of his own making, of wagons, carts, tumbrils, wheelbarrows, ploughs, spades, etc., etc.; and, in addition to this, to hold a kind of regular school for instructing the young Persians put under his care in surveying, mapping, geometry, etc., etc." [355].

"When the wheelbarrows were placed before the Prince Royal, one of the Persian Noblemen (who always affected to despise European Improvements) said; "This is all mighty well, but it will consume a considerable space of time to empty these wheelbarrows", Sir James said to him, "Indeed sir, it will not; and if you only get into the wheelbarrow, I will show it will not". The Prince insisted on his making the experiment. Sir James trundled him away at quick rate and, approaching a muddy part of the square, he gave the wheelbarrow a quick cant, and turned, to the great entertainment of the Prince and the spectators, the Persian Khan into the mud".

"The Prince Royal...always spoke of Sir James Sutherland as a person who could do everything but make men.

"When the weather became sufficiently temperate, Sir James Sutherland, with the full approbation of the Prince Royal, was despatched towards the Caspian Sea, and along...the Persian and Russian frontier, to make accurate surveys of those interesting portions of the empire.

"He was attended by his Persian scholars, with whose docility and improvement he always expressed...himself much pleased, while these youths on their part beheld and treated him with that reverence and respect which ignorance is so ready and so willing to bestow on intelligence. How well, how accurately, Sir James executed the task assigned him, the public, from the map which he presented me, and which I published last year, is now able to judge.

"I had already paid the Effendi very acceptable attentions on his arrival in Persia, by sending Sir James Sutherland to meet him on the Persian frontier, beyond Erivan[4]; and I must say that Sir James' amiable manners not only made him a great favorite with the Effendi, but also that Sir James' prudence and judgement kept the Persians of the lower classes from behaving rudely to him on the road"[5].

The Harford Jones mission was broken up on the approach of Sir Gore Ouseley's embassy from England, and Sutherland accompanied Jones overland, through Erevan and Erzeroum, to Constantinople. "The Shah", writes Jones, "put under my care to proceed to England, two Persian youths of good families to be educated there and instructed, the one in medicine and astronomy, the other in painting". They were placed under the care of Sutherland, and "regarded him in the light of a parent".

From Constantinople the mission continued the journey in HMS. *La Pomone*, which was wrecked at the Needles on the evening of 11th Oct. 1811, without loss of life. The incident is thus described by Jones or Brydges; "One of the passengers in his terror, seeing the Needle Rocks towering above, cried, 'The Rock, the Rock'. Sir James Sutherland, who was by me, and loves to his heart a bit of waggery, immediately said to him, 'Dear Sir, there is no rock there, what you see is the mizen sail, and we shall soon be afloat, but she will start with a tremendous lurch, and I advise you to go below and take care of your things, that when this happens they do not roll over one another'. The poor man became calm in an instant, and said to Sir James, 'Thank you, Sir' and went quietly down"[6].

Sutherland lost most of his kit and maps, and Brydges was led to this surprising comment; "I am quite sure that if the collection of Observations, Bearings, etc., which were made by him during our route from Tauris to Constantiniple, had been saved from the wreck of *La Pomone*, the feeling for their unfortunate loss would have been with others the same as with myself"[7].

He continues; "For my collection of maps, ... I have purchased at high prices...a variety of maps of that empire, ... not one of which...has the smallest pretensions in the accuracy with which the different ranges and ramifications of the mountains, rivers, and the position of the cities, are laid down; or in the clearness or neatness of execution, with the map now furnished to the world by my excellent and most ingenious friend. ... I am proud to say that the King not only permitted a copy of this map to be presented to him, but, with that readiness to promote science in all its branches which has invariably distinguished the Royal Family, and more particularly our present gracious Sovereign, His Majesty was graciously pleased to bestow on him a signal mark of his royal approbation and favor"[8].

Brydges, had intended to include in his next book, *The Dynasty of the Kajars*, together with other plates, "*A map of Western Persia*, from actual Survey, by Colonel James Sutherland, Engineer to the Mission", but regretted, "owing to the great labour attending the engraving...that it cannot accompany the Persian maps given with this volume. It shall be published, however, as soon as it comes out of Mr. Neele's hands"[9].

Copy of this map now with BM. bears imprint; "London, published July 12th 1833, by John Bohn, 17 Henrietta Street, West Strand".[10]

[1] Bo MC. 134, 8–9–08. [2] by Sir Harford Jones Brydges, Bart. 1834. [3] James Justinian Morier (1780–1853), *DNB.*, author of *A Journey through Persia...1808 and 1809*. 2 vols. 1818. [4] 180 m. NW. of Tabriz. [5] Brydges (149, 160, 336, 340, 351). [6] ib. (440, 461). [7] ib. (xv n.; xvii). [8] ib. (360); the exact nature of this honour is not known; possibly permission to wear KLS. [9] Map engraver of 352 Strand. Harford Jones [cxcii]. [10] BM. Maps 51170 (1).

An interesting reminder of these missions to Persia is recorded by Lord Curzon, who found inscribed on the gateway to the ruins of Persepolis, "in large characters, the name of Capt. John Malcolm, Envoy Extraordinary, Pleni-Potentiary, A.D. 1800, coupled with those of Captain William Campbell, Captain J. Colebrooke, and G. Briggs[1], and, just below, those of Sir Harford Jones, Bart., KC. 1809, James Morier, H. Willock, T. Sheridan[2], J. Sutherland; and again, Captain John Macdonald, 1808, 1810, and 1826. ...

"Of Malcolm's second Mission in 1810, including, among other names, those of H. Ellis, Lieutenant Monteith, Lieutenant Lindsay, and Lieutenant Pottinger; of S. Manesty, British Envoy in 1804, with his retinue. The earliest recorded date that I noticed was 1704. To the intervening period belong Carsten Niebuhr, 1765 [I, 120], and W. Francklin, 1787"[3]. To all these Curzon added his own name.

Bo GO. 31–1 & 2–2–14; having returned to India, Sutherland resumed his post of Asst. to SG., and "likewise to act as Assistant to that Officer in the Revenue Survey of the Northern Purgunnas", or the Broach svy. [188, 323, 339].

Continued on svy., being appd. ASG. Bombay, 1822, and then DSG., proceeding on furl. 1826.

Bombay Wills, 1853; letters of admn. were granted to his widow "Dame Maria Sutherland", and described him as "Knight".

SWANSTON, Charles. Mad. Inf.
bapt. 11–12–1789. d. 6–9–50.

Lieut. 17–7–05; Capt. 23–4–24; ret. 1–1–23.
Son of Robert & Rebecca Swanston.
m., 26–2–21, Miss Georgiana Sherson.

April 1806, MMI., cl. II [320]; MGO. 17–11–08, to Bombay for duty under Malcolm, and employed there on mapping [131 n.10]; April 1809, to Travancore svy. [132]; Map of Trichūr[4], with Chavasse, 1809 [132 n.7].

April 1810, at capture of Mauritius; served with Pioneers; "appointed to make a Military Survey of the Island, including the sounding of its harbours and coasts";[5] MMC. 27–10–12, sent "to England in order to deliver his work to His Royal Highness the Commander-in-Chief", being specially commended by the GOC. Mauritius. Presented with a purse of 500 guineas. Declined comn. in Royal Staff Corps[6].

MMC. 11–1–15, on return to Madras, appd. Asst. 2nd. cl. in QMG.'s Dept., svy. branch [322]; stationed with Subsy. Force, Poona.

Marātha War, 1816–8; MI. at Karegaon[7], on right bank of Bhima R., shows him belonging to Poona Auxiliary Horse; wounded at "battle of Corigaum", 1–1–18.

1825; paymaster.

SWINTON, James. Mad. Inf.
b. 13–5–1785. d. 2–11–13, Madras; MI. St. Mary's cem.

Lieut. 21–9–04.
Son of Archibald & Henrietta Swinton.

April 1805, MMI., cl. I [126 n.4, 320]; Dec. 1807, to Lambton's svy.; on duty with St. Leger's force during operations in Travancore, Dec. 1808 to March 1809, remaining on svy. in Travancore till rains [132, 439]. Resumed svy. under Lambton, completing 2ndy. trgn. along S. coast—Pālamcottah—Tuticorin—Rāmaswaram—and principal trgn. from Cape Comorin through Travancore to Trichūr and Pālghāt [242–4, 322].

MMC. 1–11–10, appd. to commt. dept., Lambton writing 5–11–10[8]; "I most sincerely wish you every success in the field which you have chosen, and have only to regret that it is not in my power to hold out sufficient encouragement for you to remain in the Department which I have the honour to superintend, but you may rest assured that the importance of your services while acting under my orders shall be faithfully represented".

TATE, William Ashmead. Bo. Engrs.
b. 3–11–1795, Bombay. d. 21–11–71.

Ens. 12–7–12; Capt. 17–9–24; ret. 5–12–29.
Son of James Tate merch., and Sarah Pruen, his wife, probably dau. of Ashmead Pruen, Bo. Mar.
m., Bombay, 12–12–20, Elizabeth Saunders, dau. of W. T. Edwards, HM. 17th Foot.

Bo RC. 11–8–13, employed under Rev. Survr., Bombay [187, 323].

Bo GO. 5–1–14, to svy. Salsette I. from 1–1–14; continued on rev. svy. till retired.

"Himself a marvellous draughtsman", was professor of mil. drawing at Addiscombe, 1849–59[9].

THATCHER, Thomas. Bo. Inf.
b. *c.* 1775/7. d. 1840

Ens. 28–5–1798. Bt. Lt Col. 25–6–19; ret. 17–5–22.
m., Tellicherry, 22–12–03 Jane, sister of J. S. R. Drummond, Bo. Engrs. [396].
Ens., Northumberland Regt. of Fencibles before appt. EIC. cadet, 1797.

BoGO. 11–2–07, appd. Inspector of Forests, to svy. Dharmpur forests [168, 384; pl. 15].

THORN, William. HM. 29th Lt. Dragoons.
b. 1781. d. 29–11–43.

Corn. 17–3–1799 ... Capt. 23–6–07 ... Lt Col. 13–10–05.
Joined regt. in India; served in Marātha War, 1803–5, being wounded at Laswari 1–11–03[10]. Capture of Mauritius, 1810; occupation of Java, 1811–3; returned to England, 1814.
Wrote *Memoirs of the Conquest of Java*, 1815; *A Memoir of the Late War in India, 1803–6*, 1818 [86], with map [286; pls. 1, 24].
K H. 1832.
DNB.; DIB.
J GO. 21–6–12, mentioned with Mackenzie at capture of Jokyakarta; their "gallantry and conduct have always been conspicuous; ... extremely serviceable in arranging the Plan of attack" [425].

As DQMG., responsible for mil. svys. in Java, and executed various svys. himself, and compiling maps, for which, after much correspondence, he was granted 1,000 Spanish dollars [135–7]. "Copies of these most important documents, together with the Topographical Survey, were transmitted to the late Governor General [Lord Minto], and to His Excellency Sir George Nugent" [294].

His claims for reward had been strongly supported by Gillespie, then Comdr. of the Forces in Java, who reported that Thorn had "lost his health from the fatigues he experienced during this arduous undertaking, which ultimately forced him to Europe"[11] [293–4].

[1] Obviously John Briggs (1785–1875); *DNB.* [2] Thos. Henry Sheridan, Bo CS., nephew of playwright, b. Dublin Castle 1786; asst. with Harford Jones' embassy; d., Shirāz, 1812. [3] Curzon, II (157). [4] 58 B/2. [5] Vibart. [6] This corps was, 1800–37, responsible for mil. engr. construction, *v. REJ.* LVII. 1943 (81, 247). [7] 47 J/2; battle described, *Imp. Gaz.* XV (402). [8] DDn. 63 (239). [9] Addiscombe (212). [10] Thorn (231). [11] JMC. 1–8–14.

TICKELL, Richard. Ben. Engrs.
b. 10–9–1785. d. 3–8–55; MI. Christ Ch., Cheltenham.

Ens. 1–9–03 ... Lt Gen. 11–11–51.

Son of Thomas Tickell of co. Kildare, Capt. 5th R. Irish Dragoons, and Sarah Sparks his wife; nephew of Richard Tickell (1751–93), *DNB.* [159 n.9].

m., 1st., Cawnpore, 1–2–08, Mary Anne, dau. of Richard Proctor, MD., Army Surg.; she d., Calcutta, 28–9–33.

m., 2nd., London, 18–6–40, Margaret Scott, dau. of Adam Walker, Surg.

CB. 27–9–31. *Oriental Club;* Thackeray (26); Hodson, IV (274–5).

Marātha War, 1803–5; survd. road from Delhi to and from Beas R. with Grand Army under Lake [59, 62, 63]; notes in fdbk. at "Sirhind, 24th to 26th Jany. ... I cd. not find out the Lake that is laid down near Sirhind[1] in Maj. Rennell's map, nor obtain any information concerning it".

Oct. 1808, appd. survr. to Elphinstone's mission to the King of Kābul [65–6, 230], Elphinstone writing from "Darah Ismail Khawn, 20th March 1809. Lieut. Tickell was selected by His Excellency the Commander-in-Chief to be attached to this Mission on account of his remarkable ability as a Surveyor, which is well known to the Government, particularly from his Survey of the March of Lord Lake to the Hyphasis; he has hitherto been employed in laying down the route of the Embassy, and in such enquiries as can be made under the restraint necessary to prevent exciting the Jealousy of the Governments through whose territories we have passed, but the duties of the surveyors will become far more extensive after a short residence at the Court of Caubul shall have enabled me to remove any suspicions which may be entertained of the object of the British Government[2]. ... Lieutenant Tickell was removed to this duty from a station of emolument, and under circumstances of a domestic nature which rendered his removal particularly distressing to him"[3].

Owing to failure of health, Tickell handed the svy. over to Macartney, who had been helping from the start [418], and left Peshāwar three months in advance of the rest of the mission. He travelled down to Delhi via Lahore, survg. the route and obsg. lats. [66].

For several months after return to Delhi he was too unwell to complete his papers, which greatly prejudiced the SG. against him, so that when recdg. survrs. for another task he writes; "Lieutenant Tickell...has so much disappointed me, not answering the letters written to him, and never having as yet transmitted the Field Book of his survey to Peshāwar, that I cannot venture to say that he is a fit person to be employed"[4] [218–9, 310].

1811, survd. Allahābād cant., scale 6 inches to a mile[5].

1813–4, sketched part of Rewah, whilst Fd Engr. to force under Lt Col. Adams with Lindesay as asst. [47, 312, 416];[6]

Nepāl War, 4–3–16, at Makwānpur when Gurkhas sued for peace [43, 198 n.4].

Marātha War: BGO. 18–6–18, mentioned for distinguished conduct at reduction of Mundela and Chānda.

1821, with S & M. at Allahābād; BRC. 15–4–22, appd. to svy. and prepare estimate for restoration of E. Jumna canal.

TOD, James. Ben. Inf.
b. 19–3–1792. d. 17–11–35.

Ens. 9–1–1800 ... Maj. 1–5–24; ret. 28–6–25; Lt Col. 2–6–26.

Son of James Tod and Mary Heatly his wife, of Islington. m., London, 16–11–26, Julia, dau. of Dr. Clutterbuck.

DNB.; *DIB.*; *Ency Brit.*; Hodson, IV (282–3).

1805, attd. to escort with embassy to Sindhia; comdd. escort 25–2–12 till 1817. Most zealous in survg. routes and compiling maps through Gwalior, Mālwa, and Rājputana [5, 55–6, 218, 312]. The SG. writes, 8–10–06, that he did this "more from a zeal to promote useful knowledge that from pecuniary motives; the reward given to him should be liberal"[7]. Govt. did "not consider it to be proper to appoint a Surveyor with the Resident", but made him a grant equivalent to Rs. 100 pm. [328].

Sindhia spent the greater part of the year in usual Marātha fashion, harrying and ravaging wherever he went, a life which gave Tod ample opportunities for fresh svys., but was very trying to his health. He writes to the SG., July 1809; "Nothing but the very bad state of my health could have, for so long a period, prevented me replying to your favour of the 7th June last. ... I have been under the necessity of applying for an extension of leave for two months and, as I generally feel better during the cold weather, I hope to resume my labours about it's commencement. I have, however, much doubt whether I shall not be under the necessity of making a voyage to sea at the commencement of next hot season, my health having suffered so much during 4 years residence in camp, ... subject to the inclemencies of all weather under canvas"[8].

MRIO. 81 (7), survd., 1808, route Bharatpur—Jaipur—Saugor [55].

BMC. 5–12–09, appd. to svy. Sahāranpur area to find suitable line for E. Jumna, or *doāb*, canal, being thus employed about 12 months [36, 67–9, 418].

1812–3, survd. country S. of junction of Chambal and Jumna rivers [51]. When submitting map to Crawford, as SG., he writes from Gwalior, 2–8–13, "I dont know whether you will recognise in one of your *assistants* your ci-devant acquaintance at...Pentland. ... I was made acquainted long ago by...General Garstin that you were to succeed him. I preferred, however, sending my map to introduce me afresh to you, rather than by writing to you.

"This Map will since long have reached you; it has cost me any amount of pain and trouble. ... The consequence was an illness which nearly carried me off, and the effects of which I still feel. I finished my Survey at the beginning of January. ... I sent in my report; finishing my Map, Field Books, & Memoir occupied me till late in July, all which time I was employed excepting a small portion of February. I did not even accompany Sindia to the Ganges. ...

"I have been...employed...ever since I left Hindoostan...after the Peace with Sindia, upwards of 7 years. You will find several of my [maps] in your office, which were honoured by the approbation...of Lt Colonel Colebrooke & Col. Garstin. My Geographical pursuits occupy a wide Range, as far as the Indus to the West, & Nerbudda to the South. ... If my health permits, I may next year apply...for permission to visit the Western Deserts; this is a part I have long had in contemplation; but I [must] consult health, which is much broken since I have been in this Camp.

[1] 53 B/6; 32 m. NW. of Ambāla. [2] This pious hope was not fulfilled. [3] B Pol C. 27–2–09 (37). [4] DDn. 81 (153), 20–11–09. [5] *Ben Regr.* 184 (102). [6] BSC. 18–2–14 (15). [7] DDn. 81 (30). [8] DDn. 82 (212–5).

"I have had the Command of this Escort nearly two [years], and look forward to the expiration of...8 years more to join my Father in England. I have no doubt it will give you satisfaction to learn he is in good health, and enjoying all the comforts & happiness this life affords"[1].

Crawford replied, 21–8–13, "Believe me, I have neither forgotten you or your worthy father, whom I am happy to hear is keeping so well".

Oct. 1815, appd. 2nd Asst. to Resdt. with Sindhia and, B Pol C. 18–5–16, promoted 1st. Asst., the GG. noting that he "is known to the Government by his indefatigable activity and conspicuous merit in collecting and arranging historical and Geographical information concerning the region of Central India, of which so little accurate knowledge was previously possessed, and which is likely to become at no distant period the theatre of most interesting operations.

"Captain Tod has made great progress in executing a Map of that Country, composed of Materials almost entirely new, and the result of his own researches. ... He has, besides, composed a Memoir connected with the Map. ... Although...permitted to draw the allowance of Sicca Rs. 100 p.m., granted to an officer surveying a route, & keeping a Field Book, I conceive such an allowance to constitute no remuneration for labours and researches such as those in which Captain Tod has been engaged" [353–4].

Most of this time he drew allce. as postmaster in addition, and the Resdt. writes ; 7–5–16, "In the year 1808, the Governor General was pleased to appoint Captain Tod to the office of Postmaster, from the peculiar manner in which he was qualified to discharge this important trust, from his intimate knowledge of the country. ... An additional public benefit was derived from the dawks being placed under that Officer's charge, from the greater facility with which it enabled him... to collect Geographical information in his capacity of Surveyor"[2].

After retirement became Librarian to R As Soc., and pubd., London, 1829–32, *Annals and Antiquities of Rajasthan*, 2 vols., the editor of a later edn. writing; "Few men have ever known an Eastern Race as Tod knew the Rajputs. ... By the time he left India he had almost become a Rajput himself".

TOWSEY, Edward. Bo. Inf.

bapt. 23–12–1788. d. 14–7–43.

Lieut. 4–11–07 ; Capt. 23–9–21 ; ret. 6–4–22.

Son of Henry Towsey.

1812–5, Asst. to SG. on rev. svy. of Broach [323] ; 1815, leave on mc. to Cape ; on rev. svy. Gujarāt till return to Europe, 7–11–19.

TROYER, Anthony Ferdinand. HM. 12th Ft.

b. 1775, Klattau, Bohemia.

d. 2–6–65, Royamaut, France.

Ens. 1–3–03 ... Capt., 4th Ceylon Regt., 15–7–13.

Son of Joseph Troyer, of Aufkirchen, Lieut. of Dragoons.

m. a French lady of Pondicherry ; admn. of will granted, 3–10–65, to Marie Thérése Antoinette Pauline Berthier, widow, of Paris, one of his two married daus. ; left one son. under interdiction, whose share of estate was divided between the two daus[3].

JASB. Letters, VI. 1940 (2) ; bio. note by Sir Aurel Stein, KCIE.

1787, admitted to Austrian Mil. Academy, Wiener Neustadt ; 1791, Cadet-Ens. in Austrian Inf. Regt. No. 38 ; 2/Lt. 1793.

Campaigns in France, Low Countries, and on the Rhine ; wounded in 1793, and attd. 1795, to QMG.'s staff ; 1st. Lieut. 1796 ; on sick list for some months ; 1798, to N. Italy for svy. work ; attd. to Austrian army and wounded at battle of Novi, 1799 ; Capt. on QMG.'s staff, and served in Italian campaign of 1800.

1800, attd. as liaison officer to British navy at siege of Genoa, meeting Lord Wm. Bentinck, the British mil. representative with Austrian Army.

1801–03, employed in archives section of Austrian WO. preparing official record of campaigns of 1794. When Sir Aurel Stein visited WO. 130 years later, this same record was just being read, and counted a model work of the kind.

1803, granted 3 years leave, and accd. Bentinck to India [2, 130], being tr. from QMG.'s dept. to Inf. Regt. No. 49, and then to No. 54, as supernumerary ; removed from Inf. cadre 1809.

Granted comn. in HM. 12th Ft. thro' Bentinck's influence, the regt. being then stationed in Madras Presdcy. ; arrd. Madras as ADC. on Bentinck's staff, 30–8–03.

13–11–04, appd. "drawing and mathematical instructor" to the new Military Institution, with salary 250 *ps.* pm.[4] [2, 125, 164, 315–20, 331]. Bentinck took particular interest in the Instn., drafting regns. and syllabus himself, no doubt with the advice of Troyer, whose conduct of the scientific training of the young officers of the Madras army during the next 12 years was due to the sound education he had received in Austria [125–30, 312, 342].

From 1807 held full executive control and, except during the few months of the "white mutiny" [127, 313–4], appears to have maintained excellent discipline amongst the young officers, no mean performance for a foreigner.

In the earlier years he carried out much of the control trgn. himself, but he entrusted a fair share of such work, as well as the detailed instn. and supervision, to his more talented pupils and assts.

The survrs. of India owe a lasting debt to Troyer for his introduction of the planetable as the standard inst. for filling in detail svy., based on minor trgn. and the grand triangles of Lambton's trig. svy. [126, 214–6, 229]. He maintained cordial relations with both Lambton and Mackenzie, and the Madras Govt. greatly appreciated his services.

In 1812 the 12th Ft. summoned him either to join the regt. in Mauritius or to vacate his comn. as senior Lieut. The Madras Govt. could not spare him, and the matter was referred home to the Duke of York, C-in-C. in England. It was decided that he should retain his post at Madras, and be granted comn. as Captain in the 4th Ceylon Regt.[5] He had never actually served with the 12th, nor did he ever serve with his new regt.

The MMI. was closed down in 1816 under orders of the Directors [319–20], and in June Troyer took his family to Pondicherry, "where he proposed to reside until an opportunity shall occur for proceeding to Europe"[6].

1817, returned to Europe, and settled with wife and children in Paris, working at Sanscrit and other Oriental studies "dans une retraite silencieuse" until, in 1828, he returned once more to India with Bentinck, arrg. Calcutta 4–7–28 ; acted MS. 11–7–to 5–9–28. Bentinck was now GG., and, in selecting Walpole to become SG. in 1829 [448], was influenced largely by Troyer's recdn.

During his stay in Calcutta, Troyer was Sec. of the Sanscrit Coll., where he collected material for a translation of the

[1] DDn. 130 (43). [2] B Pol C. 25–5–16 (8). [3] Copy of will, dated Paris, 20–2–63, at Somerset Ho. [4] in addition to mil. pay & allces. [5] MMC. 11–5–13 & M to CD., Mil., 25–8–13 (34). He did *not* become Capt. in 12th Foot as stated in official list of Mil. Secs. Calcutta, 1908. [6] MMC. 15–6–16.

Sanscrit history of Kashmir, of which he pubd. the 1st vol. at Paris in 1840, entitled *Radjatarangini. Histoire des Rois du Kachmir*[1]. The title page records that it was "Traduité et Commentée par M. A. Troyer, member des Societes Asiatiques de Paris, Londres, et Calcutta, et publiée au frais de la Société Asiatique". In his preface he records that, in 1832, he undertook the work whilst "secrétaire du College sanskrit de Calcutta; college où quelque Pandits étaient employées à corriger les épreuves des libres que se publiaient au frais du Gouvernement". The 2nd. vol. contains an "Esquisse Géographique et ethnographique du Kachmir; Ancien et Moderne". Three vols. were issued between 1840 and 1852. It was this history of Kashmir that drew Stein's attention.

March 1834, read paper on ancient inscriptions before ASB.[2]

He records that he left Bengal in Feb. 1835, and he probably broke the journey to revisit old haunts at Madras, for Bentinck did not sail from Calcutta till 20–3–35.

Besides his work on Kashmir he collaborated in pubn., 1845 of an English translation of the *Dabistān*, a Persian record of Mughal times.

TULLOCH, Alexander. Mad. Inf[3].
b. 15–8–1788. d. 15–9–78.

Lieut. 21–9–04 ... Gen. 6–3–68.

Son of Alexander & Margaret Tulloch.

m., Tanjore, 10–8–08, Emma Henrietta, dau. of Gen. Geo. Wahab, Mad. Est.

April 1805, MMI., cl. I [320]; 1805–6, on svy. of Madras [125]; 1706–7, on svy. near Pondicherry [141]; 1807–9, on trgn. under Lambton between Negapatam, Trichinopoly, along the Cauvery R., to the Mysore border and the Gazalhati Pass; also along the coast of Rāmnād to Tuticorin [242, 322, 381].

MMC. 26–2–12, appd. Asst. in QMG.'s Dept., svy. branch; MGO. 18–5–13, to commt. dept.

WALES, John. Bo. Mar.
d. 15–1–10, Calcutta.

Vol. 4–5–1784; 2/Lt. 9–11–1792; ... Junr. Capt. 24–4–1803; Capt. before 1809.

Marine Survr. India, 14–9–09.

Possibly son of James Wales, b. *c.* 1747, Peterhead, Aberdeenshire; d., Bombay, Nov. 1795, aged 49 (MI. St. Thomas' Cath. Bombay); possibly bro. or father of James Wales, appd. Vol., Bo. Mar. 5–2–1799.

1786–7, Asst. to Blair on svy. of Chagos [I, 124], and, 1788–93, of Andaman Is. [I, 49 n.7]; 1789–94 served in *Ranger* snow [I, 48].

MRIO. 102 (4), chart of track of *Ranger*, Dec. 1791.

2–5–to 17–7–1796, drew diet money for 76 days whilst on passage from Bengal to Bombay, 1796–8, in EIC. ship *Swift*.[4]

Markham (242) records that Daniell's pubd. views of India, 1797–1809, contain "an elaborate series of views of the caves of Ellora, drawn by Mr. Wales, but engraved by the Daniell's; as well as numerous general views. They are drawn with such care and accuracy that they bear the test of comparison with recent photographs".

25–3–06 to 25–3–09, furl. to England; CM. 8–12–08, appd. Mar. Survr. in India, on salary Rs. 800 pm., taking up duty in Calcutta 14–9–09 [12, 296].

BPC. 19–1–10 (20), Master Attdt. [I, 50] reports, 15–1–10, "the Death of Capt. Wales, ... who departed this life at my house this morning at 8 A.M. As the excellent officer may be literally said to have died at his Post while endeavouring to promote the Interests of the Publick, and His Honourable Employers; and as he left an amiable Wife, and helpless young family consisting of five children, unprovided for, to deplore his loss, by dying insolvent after an arduous and exemplary Servitude of twenty-six years duration", he recds. them to the notice of the Directors.

WALPOLE, Henry. Mad. Inf.
b. 2–10–1787, Lisbon. d. 29–1–54.

Lieut. 29–1–04 ... Col. 18–4–42; Brig., various comds. Mad. Presdcy. 1841–52.

SG. of India, 1829–30.

Son of Hon. Robert Walpole, HM. Envoy at court of Portugal, and Sophia his 2nd wife.

m., Madras, 21–8–34, the eldest dau. of Maj. C. F. Smith, Mad. Est.

April 1805, MMI., class I [320]; on fd. svy. early 1807, Troyer writing; "Lieutenant Walpole, continually disappointed in the expectation of a plain table from Madras, could not begin to survey the details of his district before the middle of the current month [March], but has in the mean time carried on with a theodolite a series of triangles between Pondicherry and Cuddalore, which, added to the acquired knowledge of his ground, will enable him to finish the topography of it with so much greater expedition"[5].

In recdg. his appt. as SG., Troyer writes, 10–4–29, "During the three years during which he was under my tuition, he distinguished himself by uncommon abilities, constant application, and most officer-like conduct. He left the Military Institution in 1807, and was employed on Survey in 1808, and in the early part of 1809, when, on the occasion of his Corps [20th NI.] taking the field under Col. Close [49, 133], he joined it. Soon after, he was appointed my assistant at the Military Institution, in which situation he remained to the entire satisfaction of Government until his departure for England on Furlough in 1815 [128, 164, 319]. ... Major Walpole possessed a solid foundation of extensive mathematical knowledge".

DDn. 127 (124); acting Asst. Instr. to MMI. from 24–5–11, Garling continuing to draw allces. of the appt. whilst holding ch. of Goa svy. [399], until granted a separate allce.; Walpole was then able to draw the regular 50 *ps.* pm. as asst. instr. [319, 332].

MGO. 10–6–15, "permitted to proceed to Bengal in July to secure a passage to Europe, and furlo' for 3 years will commence from date of his Embarkation at Ft. William if within 3 months"; he sailed from Calcutta, 13–2–16.

WARD, Benjamin Swain. Mad. Inf.
b. 1786. d. 19–6–1835, Cape Town; MI. St. George's cem.

Ens. 27–8–08 ... Maj. 21–2–34.

Son of Francis Swain Ward, (1732/4–94)[6] Mad. Inf.

m., Capetown, 1825.

His father was trained in England as artist; came to India, and given comn. in Mad. Inf.; 1764, resd. comn., with other lieuts., on supersession by officers from King's regts.; dism.,[7] the Directors writing, 19–2–1766, "We have determined not to permit them ever to serve the Company again, or to be allowed to reside in, or return to, India".

Became Sec. to Chartered Soc. of Artists, exhibiting in London; 1773, re-appd. to Mad. Inf. as Capt., presenting Directors with set of landscapes of S. India[8]. CM. 2–7 &

[1] Copy of *Raja Tarangini* was sent to ASB. by Moorcroft from Kashmir in 1824; *Moorcroft & Trebeck*, II (130): Wilson's *History of Kashmir* describes a copy purchased in Calcutta. [2] *JASB.* II (118). [3] of 7th NI.; another of same name was in 14th NI. [4] Bo PC. 8–8–1796. [5] MMC. 10–4–07. [6] Foster (5) gives b. 1734. [7] CD. to B. 15–2–1765 (82). [8] VM. Exbts. 2156–61, 2181–4.

11–8–1790, Directors refuse his offer of other sketches to be engraved at their expense, and his request that 3 of his sons be appd. Minor Cadets. Lt Col. 17–3–1786; ret. same year; resided in S. India, and d. Negapatam 4–3–1794, MI. Karicop cem.

DIB.; Love III [70, 277]; *CG.* 15–9–85; *Bengal P & P* V (1); Cotton (315); Foster (5–6) *et passim.*

Benjamin Ward was admitted to obsy. survg. school as appce. 22–11–1798 [352]; April 1801, appd. to Mysore Svy. under Mather [93, 104], working with Mackenzie after Oct. 1804; from 1806 on independent svy. under Mackenzie's "immediate inspection" [110, 111, 344, 345].

DDn. 43; Mackenzie recdd. him for comn., 7–4–06, "From the good moral character, the docility and temperate conduct he has evinced on this duty, ... I conceive he might be usefully employed in the Company's military service; especially when it is known that, tho' his father had attained the rank of a field officer, ... the family consisting of five children & a widow, his mother, was...left in a destitute situation".

Again, 30–12–06, "From Sept. 1805, having completed his 7 years apprenticeship, he has drawn a salary as Sub-Assistant Surveyor of 25 Pagodas a month while employed on field duty above the Ghaats [110, 111]; from which salary he has been enabled to make a small provision for his mother (since dead), & for a destitute widowed sister with two children".

In supporting this appn., the Resdt. concludes, "From the appearance of Mr. Ward there can be no doubt of his being the offspring of European Parents".

From several of his fdbks.[1] it is evident that he had not inherited his father's talents as artist.

1807–9, employed by Mackenzie in Madras on maps and memoirs of the Mysore svy., besides being sent out on various small svys. [152]; March 1809, sent up to Ceded Dists. to start svy. near Bellary [153–4, 156 n.2, 345, 357, 362].

DDn. 83, Mackenzie writes to him, 22–7–09; "Your appointment to be Cadet has actually taken place, tho' its notification has not yet arrived. ... Meantime you ought to reflect with yourself whether...it would be desirable to you to continue in the Surveying Line. ... In my own private opinion your following this Line in addition to your Military promotion would be best. Let me know your sentiments precisely, ... also...what Native Languages you can speak, as we might try to save your being sent on that account to any of these Cadet Seminaries, which I do not much admire, & as I am acquainted with some of the Staff, I would endeavour to get you appointed to some eligible Corps; I scarcely think they would appoint you to the Engineers or Artillery; tho' these would be most advisable; any Corps of Infantry where the Commandant would be friendly would be best".

Again, 3–2–10; "I shall be very glad if the Canoul District[2] can be done by you ere your promotion takes place, as I conceive it ought to give you some pretensions to be employed in that line, ... Whether it will be attended to or not is not in my power to say, but I should certainly think it would be beneficial to you, and advantageous to that service. At the same time I would recommend when your appointment takes place that you should be some time doing duty with a corps in order to get acquainted with military duties".

And on 13–3–10; "A few days ago Dr. Berry shewed me the very handsome letter he had from Colonel Forbes,[3] mentioning that he had obtained a commission in His Majesty's Regiment. ... Having now the two services in your option, I can only wish you sincerely joy on the occasion, and leave it to your judgement and the advice of your friends".

31–3–10; "I approve entirely of your remaining to complete the survey of Canoul, and so does everyone that I have spoken to. ... You take your rank after the cadets of 1806[4]. ... You can go on to complete the work steadily and accurately without hurry, or distressing yourself by too great exposure; this I particularly recommend as it was in that very country...I myself got a very severe illness some years ago in the month of March [I, 350]. ... This circumstance of your being alone should induce you to go on continuously, not going too far in the day into the sun; and rather I would recommend your laying down your survey as you proceed, methodically, which will save time, and save your constitution"[5] [423].

17–7–10; "Whether you can be employed in the surveys I begin to doubt very much, because the Court of Directors have lately repeated their orders about all surveys being under the QMG. [298]. ... It will be...of importance, as your destination is to be military, that you should have an opportunity of getting acquainted with military duties, and if afterwards you could be employed it would be more satisfactory".

Official orders were issued, MGO. 31–7–10, for Ward to be adm. "Cadet of Infantry on this Establishment, and to promote him to the rank of Ensign, date of rank to be settled hereafter". Mackenzie at once summoned him to Madras; "I wish you on your arrival to come to my garden where you can pitch your tent and stay with me until you ascertain your future destination [421]. Col. Conway told me the other day that he would get you appointed to a Corps here. I know not whether this would be better or not for you. ... Come away as soon as you can, by any route you please; ... lose no time for any more operations, but come away at once"[6].

After handing in his maps at Madras, Ward drew svy. pay up to 10–10–10, and joined 24th NI. at Walajābād[7]. When Mackenzie was appd. to Java expn. he arranged that Ward should take ch. of the drawing office under Morison[8] [121, 130 n. 277, 303–4, 314, 336], being promoted to rank of Lieut.

Dec. 1811, to officiate in ch. of the Obsy., in the interval between Warren's handing over and Goldingham's return [196], his svy. allce. being increased to "60 Star Pagodas". MGO. 26–8–14, appd. Asst. on permanent est. of SG. with salary 70 *ps.* pm. in addition to mil. pay.

WARREN, John. HM. 33rd Foot[9].

b. 21–9–1769, Leghorn, Italy.
d. 9–2–30, Pondicherry.

Ens. 28–7–1798 ... Capt. 3–7–06; Capt. HM. 56th Foot, 26–12–11.

Son of Count Henry Hyacinthe de Warren and his wife Christine Walburge de Meurers.

m., Pondicherry, 6–3–09, Anne Laurence Alexandrine Marcilly, who d., Pondicherry, 26–12–20; left 2 sons and 2 daus.

Portrait as a boy, pl. 23 [453].

A direct descendant of Guillaume de Warren, or Warrenne, first Count of Warren and Surrey, who accd. William the Conquerer to England, 1066, and m. his youngest dau. Gondrada. The younger branch of the family settled in Ireland with the title Count of Warren. On accession of William III in 1688, Edward, the only representative of the family, having

[1] One from Jan. to 22–6–07, DDn. 66; others, DDn. 48, M 511. [2] Kurnool, 57 E, I. [3] possibly Nathl. Forbes (1766–1851); Mad. Inf.; Ens. 1782; Lt Gen. 1837. [4] CD. to M. 36/1809–10 (105–7). [5] Ward was troubled with boils [I, 350]. [6] DDn. 83, 28–7–10. [7] 57 O/13. [8] With salary 25 *ps.* pm; MGO. 12–3–11. [9] later W. Riding Regt.

supported James II, was banished and his estates confiscated. He settled in Lorraine.

John Warren's father was an inf. officer in the army of the Grand Duke of Tuscany when his fourth child was b. at Livourne, or Leghorn, and bapt. with the names Jean-Baptiste François Joseph de Warren.

Jean-Baptiste became 2/Lt. in Dillon's[1] Irish regt., serving in France, but emigrated, 24–7–1791, after the revolution. After the restoration of 1815 was granted bt. rank of Lt Col., 24–7–1816, and named Chevalier of St. Louis. His resumption of title as 24th Comte de Warren was authorised from 10–4–16.

19–8–24, cr. Chevalier of the Legion of Honour, being now known as "le chevalier de Warren".

After emigration, 1791, Warren and his bro. joined the Prince of Condé at Worms, on the Rhine in Germany, and saw service in Flanders. Being disgusted by his first experience of civil war, he left his bro., and arrd. London, Jan. 1793. Having no money, he tried to make a living as an artist, drawing and etching till, finding help from the Marchioness of Buckingham[2], a distant connection, he accepted a post in a business house in India, and sailed for Bengal. He writes;

"Mon ami, sir John de Bath[3], avait fait de vains efforts auprès de la cour des directeurs pour obtenir un passage gratuit à bord d'un des navires de la compagnie en partance pour le Bengale. Il n'avait pu y réussir. Décidé à partir, je me rendis une après-midi au café de Jerusalem, près de la Bourse de Londres, où les capitaines de navires indiens ont coutume de se réunir, et je demandai au garçon s'il y avait dans la salle quelque capitaine dont le navire fut en partance". He introduced himself to a Captain Hodgson[4], "et je lui dis sans détours, que j'étais un emigré, avec peu d'argent, que s'il me prenait à son bord, il me rendrait un service que je ne pourrais jamais assez reconnaitre, et je lui donnai quelque noms de personnes comme référence. Ce brave homme en parla à ses officiers et m'inscrivit comme simple matelot sur le role de l'équipage"[5].

He arrd. Diamond Harbour, on the Hooghly, 10–12–93, with letters of introduction to indigo planters who, after a few months, sent him up to Bihār to open a new factory[6]. He left Calcutta by boat Sept. 1794. "Ce voyage faillit lui couter la vie. En effet, un coup de vent furieux chavira le petit navire, nommé Budgerao, sur lequel il se trouvait. Il réussit à s'accrocher à la quille avec deux amis, MM. Shaw et Bradford[7]. 19 personnes furent noyés dans cette aventure".

After four years Warren found that indigo planting was not so profitable as it had first appeared. In Jan. 1798 he was offered a post as dmn. in CE.'s office on Rs. 90 pm., but Govt. refused sanction because he was "a Foreigner"[8] [I, 236].

28–7–1798, bought comn. as ens. in HM. 33rd Foot, then comdd. by Arthur Wellesley, the regt. sailing for Madras the following month. Lambton had rejoined the regt. in Calcutta, and Warren appears to have made friends with him almost at once, being "also addicted to mathematical studies" [413], and probably sailed in the same ship to Madras, as fellow member of Wellesley's "family".

1–12–1798, recdd. for promotion to Lieut., being "the oldest Ensign with the regiment"[9] and, 9–3–1799, became lieut. by purchase.

1799, with the regt. to Mysore, making a very neat and clear sketch map illustrating the marches of the Nizām's Contt. through Mysore, with sketches of camp sites and dates; eg. Malivelly. with date of action. 27th March[10].

At siege of Seringapatam asst. engr. under Mackenzie [I, 118, 351; II, 376] and under Norris made a plan of island and fortress [I, 118]; "my fellow assistant Lieutenant Arthur having been taken ill, that duty devolved entirely upon me [376]; it was performed with my own instruments, and with the only assistance of two common Pioneers to carry the flags", and "was carried on whilst I was suffering from a most severe Bowels complaint"[11]. This was the plan which Norris refused to surrender to Wellesley [I, 360]; it was later put up to Govt. by the C-in-C. as "proof of Lieutenant Warren's ability in that line...with the idea that this officer may be usefully employed on the intended survey of the Mysore Country"[12] [275].

Goldingham writes to Colebrooke in Calcutta, 24–10–1799; "Your Friend Mr. Warren is here with us, having lately returned from Seringapatam in search of health, in which he has been successful"[13].

18–12–1799, appd. Asst. Survr. to the Mysore Svy. under Mackenzie [91, 312], marching up to Bangalore Feb. 1800, and starting the svy. of Hoskote *pargana* [pl. 11, Ooscotta] early in March [94, 95, 96, 112, 114, 230, 235, 236, 359].

Much disappointed at Mackenzie's refusal of the first proposal, made in Dec. 1800, for his transfer to Lambton's svy. [115, 117]. Mackenzie writing to Arthur, 12–7–01; "I hope you will see Major Lambton and Mr Warren on the way; make my salams to both. I hope the *latter* is in better humor with me; I can safely say I have no other than good will towards him, and that if any difference of opinion [arose], he never departed from the propriety of conduct becoming in a gentleman".

On another occasion he writes to Warren, 4–7–01; "The occasion of your late journey is very satisfactory to me, though I do not think it absolutely necessary that you should acquaint me of the reasons of occasional excursions, except where they are connected with the survey. I apprehend in your situation you ought to have the management of your own time, and you may be confident I have that reliance on your good will to the work in hand as not to render any particular account necessary. These occasional excursions are even useful to enable one to return with more satisfaction to renew a work which is some times fatiguing enough, and requiring some intermission. ...

"The journey you made lately with Colonel Close must have been a pleasant relaxation of this kind. I am glad they are about to make a shorter road; it must be attended with many advantages, and your being called for...was very consistent with the nature of your duty. ...

"I will scarcely imagine that you will again venture in the indigo speculation on your own account, though your former experience might very well qualify you for taking a leading part in the management of such an undertaking, as the introduction of it into Mysore under any public sanction would properly indemnify you for your trouble [150]"[14].

Warren himself refers to this journey; "Colonel Close being desirous to introduce the cultivation of Indigo in the Mysore in the year 1802, and knowing that I had been engaged in that pursuit in Bengal many years ago, desired me to use my endeavours to effect it near Colar. With a view to this I procured from a Mercantile House in Madras 11 bags of Indigo seed, which was distributed among the Ryotts in that district. The Colonel being removed soon after to the Poonah Residency prevented my receiving payment for this disbursement and carriages"[15].

[1] Arthur Richard Dillon (1750–94); *DNB*. [2] Presumably wife of John Hobart, 2nd. Earl of Bucks. d. 1793; his nephew Robt. was Govr. Madras, 1794–8. [3] Possibly James Michæl Bath(e); cr. Bart. of Knightstown, co. Meath, 1801. [4] Thomas Hodgson, Comdr. *Earl Cornwallis;* sailed, Portsmouth, 7–7–93. d. 1796 on last voyage; bur. St. Helena 30–11–96. [5] From family biography supplied by le Comte Réginald de Warren [*inf*]. [6] Indigo planting started in Bihār, 1782. *Imp Gaz.* XVIII (100). [7] Probably H. C. Bradford, shown as indigo planter, Allāhābād, *Ben Dir.* 1841. [8] BMC. 1–5–98 (37). [9] *Supply Desps.* [10] MRIO. 150 (29, 30). [11] MMC. 21–6–11. [12] ib. 26–11–1799. [13] DDn. 40. [14] DDn. 66. [15] MMC. 21–6–11.

Wellesley writes to Mackenzie from Seringapatam, 29–10–01; "One of your Assistants, Mr. Warren, is here, and has been sick; he came here to place the milestones upon the road, and to finish his map. Both are finished, I believe, and he is getting better, and goes away tomorrow or next day"[1].

Arthur tells us that Warren put up these milestones at his own expense [377], and Warren himself writes that, "Having suggested to Colonel Close, shortly before his departure to Poonah, the conveniency of placing Milestones on the high roads leading from the Carnatic to Seringapatam, that Officer having highly approved of the idea, there were 262 mile stones placed by me between...the Ghauts at Naikencheroo[2] and Seringapatam, and on the lower road between Balmungalum and Bangalore. The cutting, carrying, and placing these stones I estimated at about 2 Rupees each. These were procured, cut, and placed at my own cost (as is known to all that have travelled on that road since that time), but though I was directed by Colonel Close and Mr. Webb to state what I had disbursed on this account, other business of more moment prevented them of bringing my claim forward, and I never thought it becoming to trouble them about it"[3].

Towards the end of 1801 the Directors ordered a cut of allces. [330–1, 422], and Mackenzie then withdrew his objections to Warren's transfer to Lambton's svy. [312, 322]; "I had not leisure sooner to signify my acquiescence in your relinquishing your situation...as a measure...for improving your views and prospects, and more easy and comfortable to yourself than under the present diminuation of your allowances. For, however desirous I am of your continuing in your place on this survey, I do not apprehend it would be right to interfere now with your private comfort and advantage.

"Could anything more influence my acquiescence it would be Mr. Petrie's so heartily entering into it, who...would not mean to increase Major Lambton's establishment at the expence of mine. ... This I have more reason to expect, as I myself have strictly adhered to a resolution of never proposing anything that might clash with Major Lambton's [115, 117, 119][4].

Warren was at this time on svy. of Kolār Dist. [100, 101, 112, 205–12], and was the first European to notice the existence of gold in workable quantity in this area. In a paper first pubd. in 1804[5] "he describes how he discovered, whilst surveying the boundary of Mysore, ... that the people of the country washed for gold, and that the gold-bearing soil seemed to cover an area of quite ten sq. miles. He communicated his observations to several people high in rank under the Madras Presidency, who advised him to extend his enquiries, which he did in the course of his surveys, and discovered traces of gold over a wide area" [101].

His report was sent home to the Directors, who were not greatly impressed, and did not see how the discovery could "be made beneficial to the public"[6]. Warren reports that he "never received any indemnification excepting thanks and compliments, nor indeed was I anxious for anyting else"[7].

Having completed his svy. of Kolar[8], Warren went down to Madras in July 1802, taking advantage of Mackenzie's invitation, "Should you come down here while I am at Madras I will be glad to accomodate you in my place here ; at present I have nobody with me, but if more of my friends should cast up by that time, I can still contrive to accomodate you with a room, either in the house or Bungaloe attached to it, & you will be quite at your ease & command your own time ; it is nearly 3 miles from the Fort, where I seldom go"[9] [421].

6–10–02, he handed in his maps and reports with the following note ; "Altho' my thanks for the very kind manner in which you directed my labour when employed on the Mysore Survey are perhaps not mentioned here with strict propriety, yet I hope you will excuse my availing myself of this last opportunity for expressing to you the lively sense of gratitude which I shall ever entertain on that particular account"[10].

Mackenzie responded, 19–10–02 ; "The ardour you evinced in carrying on the work, particularly under the circumstances that attended its conclusion, could not but meet my particular approbation. Your sentiments on the occasion of our several duties separating us could not fail of being pleasing to me, tho' you estimate perhaps too highly what was justly due to yourself, & the wish of forwarding the service that was ever manifested in your exertions from our coming together"[11].

Joining Lambton 7–10–02, Warren was employed the next six months on filling up Lambton's main triangles by secondary work, and sketching in the main features between Madras and Pondicherry [3–4, 101, 102, 119, 237]. In May 1803 he made a check measure of Lambton's baseline on the race-course at St. Thomas's Mount, and fixed its height by connection to the beach [256–7]. He then continued trgn. N. as far as Pulicat and W. to the meridian of Vellore, reconnoitring the country so that Lambton could best arrange his great triangles for striking out W. across the peninsula [238–9, 253, 333, 369].

When Lambton started obsns. to the W., Warren took his advance trgn. along the south of Mysore [379–80], and in May 1804 started meast. of new base-line near Bangalore, where he spent some months helping with compns. whilst Kater took over the advance trgn. [255–7, 259, 410]. In Oct. he was sent forward again to carry triangles SW. over the Ghāts, and down to the W. coast [241] and then left to take ch. of the Obsy. in place of Goldingham, who went on long leave in Feb. 1805 [163, 190, 402].

The Directors protested against the selection of a King's officer, and sanctioned the appt. as a temporary expedient only[12] [313]. Warren now held the posts of Astronomer, Marine Survr., Supdt. of the Survg. School [2, 140, 142, 194, 195–6, 317, 341, 344, 347], and Inspector of Rev. Svys [142–8, 226, 277, 299–300]. As Mar. Survr. he survd. the anchorages at Coringa Bay and Vizagapatam between Oct. 1805 and June 1806 [159–60].

His most notable work at the obsy. was the deduction in 1807 of a value for long. of Madras, which was retained for deptl. maps until 1905 [195].

Other contributions to science appear in two articles in *Asiatic Researches* on experiments made, one in Mysore "in the year 1804, to investigate the effects of terrestial refraction" [260], and another "at the Observatory...for determining the length of the simple pendulum beating simple seconds... and some remarks on the ellipicity of the earth"[13].

[1] *Supply Desps.* [2] Naykhaneri? 57 L/9. [3] MMC. 21–6–11. [4] DDn. 66., 8–1–02. [5] *As AR.* 1804, *Misc. Tracts* (1, 7); *JASB.* III (463), Sept. 1834. [6] CD. to M., Pub., 27–6–04. [7] MMC. 21–6–11. [8] Map. MRIO. 146 (32). [9] DDn. 66, 2–6–02. [10] Memoir, MRIO. M 115. [11] DDn. 41. [12] CD. to M. 9–4–06 (26). [13] *As R* IX, 1807 (1–23); XI, 1810 (203–308), sd. 1–6–09.

1806, purchased captaincy in 33rd Foot.

Feb. 1807, had correspondence with Rennell about the svys. of Persia brought back by the asst. survrs. with Malcolm's mission of 1800–1 [I, 286, 375 ; II, 173, 280].

MGO. 14–9–07, appd. ADC. to Wm. Petrie whilst he acted as Govr. for 3 months.

1–5–08, obtained "the Governor's leave to be absent from the Presidency for the space of two months (or more if necessary) for the recovery of my health. The place I intend to proceed to is Point Calimere, and eventually Cotallum[1] in the Tinnivelly District" [144]. At Pondicherry he met his future wife, and took leave again the following year to marry her.

Nov. 1810, on the appt. of Mackenzie as SG., Madras [299] the appts. of Inspector of Rev. Svy. and Supdt. Survg. School were abolished, and Warren remained Astronomer only[2]. On the departure of the expn. for Java, he was appd., (MGO. 24–4–11) to be acting Bde. Maj. of King's Troops in the Madras Presdcy. and extra ADC. to the C-in-C., Gen. Pater[3]. He held the offices of Bde. Maj.—DAG.—and DQMG., King's Troops—at different times till 1813.

16–9–11, asked to resn.; "The time when His Majesty's 33rd Regiment is about to return to Europe being fast approaching, and my private and Family affairs requiring urgently that I should, during the short interval I have to remain in India, ... be absent from the Presidency, I have to request...to resign on the 1st of October next the Office of Acting Astronomer, to which I was appointed in December 1804 for three years during Mr. Goldingham's absence.

"I have projected the Eclipses, and completed the Calender for the year 1812, and observed with success the last Moon Eclipse in this year. Nothing therefore of importance remains to be done for some time to come, and I hope that in consideration of my protracted service at the Observatory...and of the present situation of my Family, Government will be pleased to permit me to retire"[4] [196, 303].

He was relieved on 26–12–11, but did not accompany the 33rd when they left India owing to money troubles, caused, he says, by the failure of his bankers, Harrington & Co. He exchanged into the 56th Foot[5], 26–12–11, and served with that regt. in campaigns against the Marāthas till 1814.

Submitted to ASB. "An Account of the ancient city of Bijapore, in the Mahratta Deccan",[6] which he had visited in 1813.

News of the restoration of the French monarchy reaching India in Sept. 1814, he obtained leave to Europe and, leaving his wife and younger children at Pondicherry, sailed in the *Phoenix* on 5–3–15[7], with his eldest son, Edward, and reached France 14–10–15. He was reinstated in the French army, 24–7–16, with the brevet rank of LtColonel, and admitted Chevalier of St. Louis. His mother and sisters were alive to greet him. On the death of his eldest brother he applied for recognition as head of the family, and became 24th Comte de Warren, 10–4–16.

Amongst his happiest reunions was that with the Duke of Wellington in Paris after Waterloo. "Le duc lui avait fait une réception des plus gracieuses, l'avait invité à sa Table, et apprenant de lui qu'il laissait en France un jeune fils qu'il voulait y faire élever, l'avait blamé de cette resolution, et s'etait engagé, s'il voulait faire de moi [his son Edward] un Anglais, à m'accorder un jour sa protection, et à me procurer plus tard un sous-lieutenance"[8].

During his stay in Paris Warren met many men of science, including Laplace and De Lambre, who were all most interested in his accounts of Lambton and his great work, and he was himself elected corresponding member of "le Bureau des Longitudes"[9].

Leaving Edward to be ed. at Nancy, Warren returned to Madras, sold out from the 56th, which was now in Mauritius, and settled in Pondicherry with his family. On behalf of the Coll. of Ft. St. George, he undertook the translation and editing of a collection of memoirs on Hindu chronology, which was pubd. in 1825, under the title of *Kalasankalita*[10].

Wrote long and intimate personal account of Lambon's career, pubd. in local press 1824–5; quoted here under ref. "Warren" [264, 411].

After the death of his wife, 26–12–20, he took up the study of French law, was appd. councillor at the Court of Justice, 8–9–25, and advanced to Judge of the Ch. Court, Aug. 1828 to 13–4–29. Appd. Chevalier of the Legion of Honour, 19–8–24, being decorated in 1829.

It is reported that he was so popular that on the occasion of the marriage of his 2nd dau. in 1829, "les Hindous voulurent payer les frais des fetes. ... Bien mieux, le jour de marriage, le chevalier était trop faible pour pouvoir se render à l'église, il fut porté en triomphe à bout de bras".

When in 1823 it was proposed to carry out an astr. svy. over those parts of India that could not well be covered by the GTS., Blacker suggested Warren as the most suitable officer[11], saying that he had "no personal knowledge of any individual in India equally qualified. ...

"Mr. Warren was formerly in His Majesty's Service, and sold out as a Captain of the 56th Regt. at the end of the last war thro' despair of further promotion. He was about three years an assistant to Major Lambton, and almost continually employed on detached and confidential duty. He officiated during about six years as Company's Astronomer at Madras, and vacated that situation on the return of Mr. Goldingham from England. ... He married a lady of French extraction at Pondicherry where he now resides; but being at present a Widower is, I am well informed, desirous of again undertaking suitable employment". In their letter of 4–5–27 the Directors approved this proposal and, unaware that Warren was now 58 years old, suggested that he might succ. Goldingham at the Madras Obsy.; the whole scheme for this astr. svy. was, however, abandoned.

Left four children ;

Edouard François Patrice, b., Madras, 8–1–11.

Marie-Therèsè Emilie, b. Pondicherry, 27–12–12; m. M. Pierre Pognon, Inspector of French Marine.

Marie Elizabeth, b. Pondicherry. 6–12–14; m., 26–11–29, Adolphe Guillaume Mottet de la Fontaine, Sous Commissaire de la marine, later in the service of the Nizām.

Henry Hyacinthe, b., Pondicherry, 18–5–18.

Edward, the eldest son, has left the story of his life in a book entitled "*L'Inde Anglaise en 1843*", pubd. 1844[12]. Left in France at the age of 5, he followed in his father's steps. He went to England in 1830, and obtained a passage to India as mdpn. in a merch. ship, and arrd. Madras 1–5–31, only to find at Pondicherry that his father had died, and his elder sister alone to welcome him.

With the help of friends he had prepared a memoir of his father's services with the British, and "muni de cette pièce, ... je répris la route de Madras où j'arrivai au commencement de juin". Here he met two officers of HM. 55th Foot[13], one of whom was willing to sell his comn. as 2/Lt.; Edward persuaded the colonel to forward the precious memoir to England,

[1] Kuttalam, 58 H/5, a favorite health resort. *Imp Gaz.* XVI (58). [2] M Rev Bd. 22–11–10. [3] The family record wrongly assumes that he accd. the expn. to Java. [4] MMC. 20–9–11. [5] later the West Essex Regt. [6] *As J.* Jan. 1821 (47). [7] *Mad Gaz.* 4–3–15. [8] Edouard de Warren, I (16). [9] *Govt. Gaz.*, 22–6–20. [10] See paper by Dr. W. E. van Wijk, Curator of Museum, The Hague. 1938. [11] DDn. 204 (9), 26–12–23. [12] Also author of *European Interests in Railways in the Valley of the Euphrates.* 1857. [13] Westmoreland Regt.

and himself wrote to the Duke of Wellington, recalling the promise made in 1815. Eleven months later he was nominated as purchaser of the vacant comn., having spent the interval travelling in S. India, till, hearing the good news at Hyderābād, he joined the regt. at Bellary 18–9–32.

After about 20 years service he retired to France and married. His eldest son, Lucien, left six children, one of whom, Paul, was mil. govr. of Strassburg in 1940, where he was severely wounded and taken prisoner by the Germans. One of Paul's sons, le comte Réginald de Warren, has been most heplful in supplying infn. about his gt-gt-grandfather, our surveyor. Réginald was fighting in France in 1940, and later with Free French through W. desert, Tunisia, and Italy, and with landing on S. coast of France, Aug. 1944, being promoted to Major[1].

Henry, the second son, was ed. at Mauritius, and also bought a comn. in the 55th Foot; he tr. to a Ceylon regt., and d. 25–12–52.

The following are extracts from John Warren's will dated Pondicherry, 7–4–25[2].

"Je légue specialement à mons fils ainé ma caisse d'instruments de Mathématiques, montée en argent, et marquée à l'extérieur de mon nom", and gold watch marked Hugh Gordon[3], Fort St. George.

"Je leur recommende de mine d'honneur, servir, et aimer leur Rois légitimes, ainsi que l'ont fait tous leurs ascendats, tant Irlandois que François, depuis le regne de Charles I, Roi d'Angleterre, jusqu'a celui de Louis XVI, et après lui de Louis XVII et XVIII, Rois de France.

"Je leur recommende au fin la plus parfaite union et sincère amitié entre eux, suivant en cela l'example des quatre enfants de mon très honoré père, du nombre desquels je suis. ...

"Je déclare ne laisser aucun enfant naturel, et n'en avoir jamais eu, à ma connaissance".

Codicil, 7–4–28; his son Henry about to depart for Mauritius; "Altho' in my English correspondence I have ever been in the habit of signing JOHN WARREN only, yet I declare the above to be the Christian names I bear in the Certificate of Baptism.", viz., Jean-Baptiste François Joseph.

2nd Codicil, 12–11–29; "My daughter Mary Elizabeth is shortly to be married to Capt. Adolphus William Mottet, of Nizam's service, a french subject; he is appointed joint executor".

The original painting from which plate 23 is reproduced was, in 1935, hanging in a Normandy chateau, residence of Paul, 3rd son of Lucien and father of Réginald de Warren [*sup*].

WEBB, William Spencer. Ben. Inf.
b. 2–12–1784. d. 4–2–65.

Ens. 20–11–01 ... Capt. 9–11–18; ret. 29–6–24.
Son of Wm. & Mary Webb, of London.
Oriental Club; Hodson, IV (416–7).

ed. Christ's Hospital, passing Trinity Ho. examination, 31–10–1799; granted certificate by Master of Royal Math. School that he had "completed his theoretical studies in Mathematics and Nautical Astronomy, ... occupying a period of nearly three years, at the expiration of which...he quitted the school to join H.M. Ship Amazon. ... His regular and diligent application to study, the facility with which every precept was imbibed, and the permanency with which it was retained, combined with his examplary conduct in every particular (superior to that of any of his fellow pupils), induced a pleasing expectation that his future life would prove valuable to his country and creditable to himself"[4].

One of his first experiences in India 1802–3 was to join Lord Valentia; "My escort consisted of a company of the 10th Native Regiment, commanded by a young officer of the name of Webb, for whom I applied in consequence of the recommendation of several of my friends". Leaving Lucknow, "set off on an Elephant for Futtygunge, Mr. Webb on another"[5] [406, 410, 414].

1805–6, survd. several routes with his unit, commended by the SG. [27, 199, 309].

BGO. 9–11–07, being stationed at Delhi, appd. to comd. SG.'s escort, Colebrooke having specially applied for him because of his "abilities as a surveyor" [358]. Leaving Cawnpore, 17–12–07, marched through Lucknow to Bareilly to svy. the N. districts of Rohilkhand, close along the foot of the hills, Webb taking share in the svys. [32, 389]. Being prevented by bad health from further active work Colebrooke deputed Webb to explore the upper course of the Ganges. Starting from Hardwār, 13–4–08, with Hearsey and Raper as companions [404, 438], Webb reached Raithal,[6] on the Bhāgīrathi, 37 m. short of Gangotri, being unable to get his transport ponies any further along the rough track. The party then ascended the Alaknanda, and reached Badrināth[7] before they were peremptorily recalled by the Gurkhas at Almora. After several anxious weeks they rejoined Colebrooke at Bareilly, 30–6–08 [5, 6, 33, 73–8, 80, 83, 87, 88, 192, 310, 340, 389; pl. 9].

By this adventurous journey Webb not only brought back geographical material based on unimpeachable svy., including position & heights of snow peaks, but finally scotched the Lamas' picture of the westerly sweep of the upper Ganges [I, 70; pl. 7; II, 79]. Much to his disappointment the Gurkhas would not agree to a second expn. by which he hoped to fix the Mānasarowar Lake [79, 438].

BGO. 4–7–08, appd. "Surveyor in the Upper Provinces", but "seized with a jungle fever immediately on his return to Bareilly", and was unable to start outdoor work till October [5, 6, 33–4]. For the next three years he made svys. of NE. Oudh and Gorakhpur [34, 312, 329, 353–4, 382]. BGO. 27–1–12, being "incapacitated on account of a spleen complaint", granted leave to England [34, 382].

Though a most zealous and efficient survr., and skilled at astr. obsns., he confesses to being a very poor dmn. [76]. He writes to the SG., 8–2–10, "the plan sent is certainly, in point of execution, a most wretched daub, for I have lost the Draughtsman who used to assist me[8], and although I have always acknowledged my incapacity in this way, I think the necessity I have been under to work when fatigued, ... and at night, has either increased my natural want of ability, or that I grow worse and worse"[9]. His maps, however, whether drawn by himself or another, are neat and legible, and his hills bold and expressive [pl. 7, 9].

Whilst on leave Webb took special courses in astronomy, with a view to improve his skill as survr., and took back with him to India two certificates. One, 20–2–14, from "Thomas Firminger[10], late Astronomer at the Royal Observatory, Greenwich—Lieut. W. S. Webb...has during his present stay in England attended me for the purpose of extending his

[1] b. 1909/10; Address, 1939, L'Olivette de Malbosc, Alpes Maritimes. 1946–7 French Consulate General, Sofia. [2] Madras Wills, 1830. [3] of Gordon & Co. jewellers, Madras. [4] DDn. 143 (107), 26–5–11. [5] Valentia, I (139). [6] 53 J/NE., near Bhatwāri RH., 62 m. from Tehri 53 N/6. [7] Village & temple, 10159 ft., 15 m. E. of peak, 23190 ft. [8] presumably Hearsey [340, 404–5]. [9] DDn. 82 (111). [10] of Egerton, Kent, g. father of Rev. Thos. Aug. F., auth. of *Manual of Gardening for India*, who was father of Archdeacon F., historian of Calcutta.

knowledge in practical Astronomy. ... He has procured the necessary instruments, most of which I have suggested and directed to be procured from the best makers. With such instruments, and the abilities which Mr. Webb possesses in the use of them, ... he will be able expeditiously to settle the Latitude and Longitude of places with great precision".

Another from "A. Robertson, Savilian Professor of Astronomy, Oxford[1]; March 2nd. 1814. ... I have seen the Instruments he has provided, and consider them in every respect adequate to the purposes intended, neither can I doubt from the celebrity of the Artists he has employed, that they will prove of the most perfect description"[2].

Before leaving England, Webb drafted a request to the Directors for appt. as astr. survr. in India; "In the performance of my duty as a Surveyor I was engaged in an arduous...journey...for the purpose of examining the upper Branches of the River Ganges. ... I sustained considerable loss in Books, Instruments, and Baggage. ...

"Being originally intended for the Navy, I received a regular education in the rudiments of Mathematics and practical Astronomy. I have provided myself with chronometers and an Astronomical Apparatus, in all probability more perfect than had been hitherto carried in India by any Individual"[3].

On arrival in India he submitted this letter and the certificates to the SG., 5–12–14; "They had not been presented to the Court at the time I quitted England (in June last), it having been suggested to me that their appearance would be most suitable when the Regulations for the Surveyor General's Department recommended by their Committee should be brought under discussion [306]. ...

"I have been employed some years in your Department under Colonel Colebrooke and General Garstin. I lost my health in the performance of its duties, and was compelled to return to Europe on account of sickness long before the surveys of Oudh and Goruckpoor...were completed. ... I...solicit... permission to commence immediately upon examining the state of my chronometers, etc., after the voyage [231, 191–4], ... preparatory to commencing a regular series of astronomical observations. ... I shall suffer no small inconvenience...if, upon the arrival of my Baggage from Sagor', I am obliged to quit Calcutta immediately to join my Corps, which now, I believe, composes a part of the Governor General's Escort"[5].

Owing to the outbreak of the Nepāl War, he only had a few days in Calcutta before reporting as Bde. Maj. to Nicholls' force that occupied Almora[6] [90].

BSC. 25–4–15, appd. Survr. in Kumaun, continuing on that svy. till he left India in 1821.

WEBBE, William. Asst. Survr., Madras.
b. 1784–5.

Appce. 10–5–1794 [I, 284]; tr. to Bombay est. 1812.

BMC. 25–1–12; Malcolm reports that "Mr. Webb is the son of a Sergeant of one of the Regiments in the Company's Service by a Native woman; was educated at the Male Asylum of Fort St. George [I, 283 n.7], which he left in 1794, having been in that year bound apprentice at the Observatory School of that Presidency; his time expired in 1801, and he has since then been always actively employed as an Assistant Surveyor.

"He was with me from the end of 1799 to 1801 during my first mission to Persia, and has been employed under my orders since January 1809" [I, 286]. Malcolm continues by recdg. Webbe for promotion from 2nd cl. Asst. Survr. @ 35 *ps.* to 1st cl. @ 45.

1802–4, on rev. svy. in Malabar; 1804–6, employed under Collr., Madras; 1806–8, at the survg. school where he compiled map of Malcolm's routes through Persia and Irāq [280]. The map gives route that he and Pope followed from Madras through Nellore, Nalgonda, Hyderābād, Bīdar, Poona, to Bombay, and by sea to Bushire, touching at Muscat and Ormuz. Along the route through Irāq are shewn—"Tank Kerserall, supposed to be part of the ruins of Ctesiphon—Alcadar, the Ruins of a most magnificent Building" [173].

Sept. 1808, joined Malcolm in Bombay [174–5], and sailed with mission to Persia, 10–1–10, survg. route to Tehrān. On return of mission was kept at Bombay, Malcolm reporting 2–10–11 that he "is the only person now with me that can aid in constructing (on a large scale) a new Map of Persia for the Supreme Government. I therefore cannot without great inconvenience dispense with his services before the latter end of December, or the beginning of January 1812, after which period I shall order him to join Lieutenant Garling at Goa". Feb. till Oct. 1812, on svy. of Goa [157], then returned to Bombay to copy Reynold's great map for the Supreme Govt.[7] and permanently tr. to Bombay est[8]. [346, 352].

Served many years under DSG. Bombay; assisted Shortrede on meast. Karli base-line, 1828.

WELSH. James. Mad. Inf.
b. 12–3–1775. d. 24–1–61, Bath.

Ens. 22–5–1790. ... Lt Gen. 9–11–46; ... ret. 1847; Gen. 1854.

DNB.; *DIB.*; Auth. of *Military Reminiscences of Nearly Forty Years Active Service in the East Indies*, 1830[9].

Nov. 1795, under Mackenzie at Rāmeswaram making gabions and fascines for siege of Colombo [I, 350].

1804, survd. "Route from Jaulnah to Surat, by the Shaderwell Ghaut, and back by the Khoondabaree Ghaut"[10]—bearings by theodolite, and "computed distances by a watch"—said to have been "poor" survey.

Visited Reynolds at Surat, and examined the great map by crawling over it with silk stockings on hands and feet [I, 219]. Reynolds later presented him with an English perambulator, which would be useful in correcting "his late routes" [I, 380].

WESTON, Charles Thomas Gustavus. Ben. Inf.
b. 13–11–1786. d. 27–5–28, Calcutta, of cholera.

Ens. 25–10–07 ... Capt. 1–5–24.

Son of Charles Gustavus Weston, of Brompton and New Clement's Inn.

m., Chunār, 23–12–23, Miss Charlotte Jane Arnold (witness Anne Weston).

Hodson, IV (432).

1810–11, expn. to Mauritius; Aug. to Sept. 1812, survd. Chilka Lake [12, 443].

[1] Abraham Robertson (1751–1826); FRS. *DNB.* [2] DDn. 143 (94). [3] BMC. 9–12–14 (96). [4] Sāgar Roads, at mouth of Hooghly R. [5] DDn. 143 (94) & BMC. 9–12–14 (95). [6] *Nepaul Papers* (582–3). [7] DDn. 127.; B Pol C. 25–11–12 (2). [8] MPC. 7–3–12. [9] ms. letter-book as M Gen. now with Maj. V. C. P. Hodson. [10] Jālna, 47 M/13; Sawalghāt, 46 H/11; Kandaibāri 46 D/4. DDn. 246 (145).

WHITE, Francis Sellon. Ben. Inf.
b. 22–8–1780. d. 19–7–50.

Ens. 28–11–01 ... Capt. 22–6–16; ret. 6–2–19.

Son of Rev. Stephen White, rector of Conington, Hunts., and Elizabeth Anna, his wife, dau. of Rev. Wm. Sellon.

m., 18–11–18, Joanna, dau. of C. G. Rees, of Cross Hall, Lancs.

ed. Westminster, 1795, *OW.* II (986); Hodson, IV (447–8).

Marātha War, 1803–5; Oct. 1805 to March 1806, survd. route of Col. Ball's dett. in pursuit of Holkar's guns between Delhi and Jaipur[1] [59, 166].

July 1806, appd. Survr. on Delhi frontier, working under professional direction of SG., and under direct orders of Resdt. Delhi [5, 59–61, 192, 198, 200, 221, 309, 310, 327]. Svy. closed down, July 1807, for reasons of economy, but re-employed Oct. 1807, on svy. of old Jumna canal, N. of Delhi [67 203, 358], Karnāl cant., and the country W. of Delhi and Agra [61, 270, 285–6, 353, 358].

April 1808, met Colebrooke, SG., during his visit to Delhi [33, 389], who "intimated to me that a Survey towards the source of the Jumna was much required, and that he was particularly desirous the situation of Nahan[2] should be more accurately defined" [41–63, 81]. The Resdt.[3] wrote to White, 19–4–08, that "the same opinion was expressed to me verbally by the Surveyor General when at Delhi. He did not however state it to me in writing, either privately or officially, from which I am led to suppose that he did not attach any very great degree of importance to the object. ... The great and primary object of your appointment was the survey of the boundary of the North Western part of our territory in this quarter". In a further comment on the visit the upper Jumna, he added that "however desirable a knowledge of that Country might be, it forcibly struck me that the present was not the time to enter upon the survey. It is true that no part of the Jumna flows in the vicinity of the territories of Runjeet Singh, but...any appearance of the British Government directing its attention to that Quarter might have rendered Ranjit Singh suspicious, and induced him to believe that something more was intended than the mere Survey of the Country"[4].

Baulked of his hopes of reaching the source of the Jumna whilst Webb survd. those of the Ganges, White applied to accy. Elphinstone to Peshāwar, submitting, 27–9–08, "a Map of Bikaneer and Shekhowat Countries[5] which, at the present moment, will I conceive be particularly interesting, as I understand the Hon. Mr. Elphinstone proposes to take Bikaneer in his way to Candahar. ...

"I was in hopes, from the General knowledge of the Country West of Delhi...acquired during a three years survey, he [the Resdt.] would have directed me, either to have accompanied Mr. Metcalfe to Lahore [62], or the Hon. Mr. Elphinstone to Cabul [65]; as it was pretty obvious that an extension of our Geographical knowledge in that quarter was of the most serious importance". After pointing out how best the route of the mission could be survd. he concludes, "I should think a Buggy could be constructed in such a manner as to answer all the purposes of a peramulator, and with the assistance of a Pocket Theodolite, used cautiously, the Survey would be sufficiently regular. I am extremely willing to accompany Mr. Elphinstone myself, and I believe he has no objection, provided it was sanctioned by Government, ... nor shall I consider myself in the least hurt, if you should deem it necessary to recommend any other Gentleman to accompany Mr. Elphinstone as Surveyor"[6] [310].

Govt. had, however, decided to send Tickell, and White replied to a rebuke for not submitting his map thro' the Resdt.; "My map (which I entertain the most sanguine expectation will be found very accurate) may, from its being laid down from Information, be considered as a private gift...to Government. ... I presented to the Resident at Delhee on the 10th of August last, for transmission to Government, a Map of the whole of my Survey on the West of the Jumnah, from Agrah to Patialah, and as far West as the Shekhawat and Bhattu Frontiers [64, 69 n.2]. This Map was executed in considerable hurry (as the Surveyor General has asked for it without delay). ... I was in hopes the Map might prove acceptable to Government and consequently beneficient to my future prospects [353].

"The fatigue undergone, and pains I have bestowed during a three years Survey, exposed, with a weak constitution, to all the vicissitudes of the Seasons, it is improper for me to dwell upon. ... I can lay my hand upon my Heart, and say that I feel confident as to the accuracy of my Maps in a geographical point of view, and that I shall never have occasion to blush at having subscribed my Name to them. ... As, on the 27th of September, I was aware from the information of a Gentleman living with Mr. Seton that my Maps were still at the Residency, I naturally concluded that Mr. S. had, from the hurry of business, forgot to send them to Calcutta, and as my Map of the Shekawat Country was peculiarly interesting at that moment, I thought it proper to forward it direct to Government. ... A regard to my present feelings, and the profound repect which is always due to the elevated situation of the Resident at Delhi, renders any further remarks improper". Govt. closed the incident by saying that they regretted the correspondence, but had high regard for White's services, and also for the Resdt.'s correctness and propriety[7].

White was now anxious to have his appt. on a surer footing, and wrote, 10–11–08, "When I was first appointed a Surveyor in October 1805, I spared neither pains nor expence to render myself qualified for the situation, & for that purpose purchased a number of very scarce and valuable books, & Instruments; having, however, been continually employed in the active duties of my appointment, I have no opportunity of paying that attention I wished to the scientifick part of the profession, & particularly astronomy. ... I trust I may...solicit that my appointment may be rendered permanent as "Head, or first, Assistant to the Surveyor General", with such allowances, & under such regulations, as Government may be pleased to direct; & I humbly presume that the appointment, though new, will ultimately prove very beneficial to Government. ... which will enable the person, should he afterwards succeed to the situation of Surveyor General, to hold that honourable appointment with credit to himself, and advantage to Government".

Reply was curt, and the SG., expressed no sympathy[8]. White was foolish and pursued the matter sending in his resn. with "a long letter of accusation" against the SG., who commented; "The very chief cause and head of my offending has been my refusal to recommend this officer to be appointed Assistant Surveyor General in the Field, to secure him a trifling addition to his allowances. I did not consider it expedient to advise it. I softened my refusal by mentioning that Lieutenants Sackville and Webb had equally strong claims to such an office as himself [310]. The last injury mentioned as derogatory to his honour was the nomination of Lieutenant Macartney to survey the Canals [67]. Lieutenant White could not well carry on Two surveys at one time; why should he be offended at another officer being employed is not to me apparent. His presuming to mention the subject and to express his dissatisfaction at his superior, ... appears to me to be a breach of decorum that does him no credit"[9].

At the end of 1808, White was employed on a large scale svy. of Delhi and neighbourhood [61], and early in 1809 he was attd. as survr. to Ochterlony's force advancing to the Sutlej [62–3, 81, 289, 329].

[1] cf. Thorn (484). [2] Capital of Sirmūr State. [3] Archibald Seton, (d. at sea 1818); BCS. 1779. [4] B Pol C. 30–5–08 (53–4). [5] Shekhāwati, NW. dist. of Jaipur. [6] B Pol. C. 24–10–08 (23). [7] ib. 7–11–08 (23–5). [8] ib. 28–11–08 (1), & DDn. 81 (85, 8–4–09). [9] DDn. 128 (1–4), 26–2–11.

He had many adventures with the Sikhs, eventually losing most of his insts. and baggage in an affair near Bhatinda [8, 64, 363–5].

BGO. 29–10–11, appd. "to survey the upper part of the Dooab from Futtehghur, including Saharanpore and Meerut" [36–7, 219, 312], and continued, with Hodgson as asst., till, he resd. in Oct. 1813, on account of ill-health, asking for "a situation of a quiet and sedentary nature".

During 1815 employed on a large scale svy. of the suburbs of Calcutta [18, 310, 312]; BGO. 22–12–15, granted leave "to Europe for the recovery of his health", and sailed shortly after in the *Huddart*, taking the following appreciation from Crawford, then SG., 11–9–15; Your approaching departure for Europe affords me a pleasing opportunity of certifying that your Geographical labours for these last ten years have been carried on with that degree of attention, zeal, and accuracy, as not only reflect the highest credit upon yourself, but has also been of the greatest use to this office. The great accuracy of your maps I have in the course of my compilation often proved, and when it is recollected how often you risked your personal safety whilst surveying the countries of the uncivilized, it surely strongly marks the degree of perseverence, assiduity, and zeal, with which you were actuated"[1].

WHITE, Henry. Mad. Inf.

bapt. 27–6–1790. d. 21–5–35, Madras; MI.

Ens. 27–6–06 ... Capt. 1–5–24.

Son of Thoms. and Mary White, of Lambeth.

m., Arcot, 1–11–20, Elizabeth, dau. of Rev. H. Jeffreys, of Ilford.

July 1812, MMI., cl. VI [321]; MRIO. M 146, 567, descriptive memoir of area surv'd. with MMI.; MGO. 21–1–15, posted to QMG.'s Dept., svy. branch.

1818–20, AQMG., Nāgpur; surv'd. route through Nāgpur–Berār–Nizām's territory, MRIO. M. 220.

1829, recdd. to be SG. of India.

WHITE, Henry Lewis. Ben. Inf.

b. 1788/9. d. 28–3–50.

Ens. 7–4–05 ... Col. 26–12–44; furl. 17–8–40 till death.

Son of Samuel White, of London, and Mary his wife.

m., Calcutta, 25–1–15, Catherine, dau. of Wm. Browne, of Howrah.

Hodson, IV (449).

Feb. to June, 1808, surv'd. routes of his batt., 18th NI., in Oudh [27].

1809–10, with Elphinstone's mission to Peshāwar [66].

WIGGINS, George William. Ben. Inf.

bapt. 13–11–1781. d. 7–1–08, Cuttack.

Ens. 2–10–1797 ... Bt Capt. 20–10–05.

Son of Thomas Wiggins, MP. for Okehampton, and Hon. Margaret, his wife, dau. of Charles, 6th Baron Kinnaird.

m., 20–10–1800, Miss Caroline Collins, who afterwards m. H. E. Gilbert-Cooper, Ben. Inf., Hodson, I (384).

Hodson, IV.

Jan–Feb, 1805; surv'd. march from Cawnpore; "distance accurately measured by perambulator, except in [two] night marches, when it was computed by watch"; sketched Jumna between Agra and Muttra, and reconnoitred all the fords[2] [198 n.2].

WILLIAMS, Monier. Bo. Inf.

b. *c.* 1777, St. John's, Newfoundland. d. 30–11–23, Naples; MI., in old Protestant cem.

Lieut. 28–12–1798 ... furl. Nov. 1821; Lt Col. 9–1–22.

SG., Bombay, 1807–15.

Son of George Williams, Chief Justice of Newfoundland, and Marie Monier, of Jersey, his wife.

m., Bombay, 28–12–11, Hannah Sophia, dau. of J. T. Brown, of EIC. service; father of Sir Monier Monier-Williams (1819–99), distinguished orientalist (*DNB.*), besides 3 other sons and 2 daus.

Held comn. in Royal Newfoundland Regt., 25–4–1795, to 11–4–1798.

On arrival Bombay recdd. by CE. for appt. to Engrs.; "He is a young man of considerable experience, having been some years in His Majesty's Service, in which he served for some time as an Engineer. He draws extremely well, and understands Trigonometry, mensuration, and several branches of the mathematics"[3].

With five other inf. officers was attd. to Engrs., but "the great want of subalterns of Infantry made it necessary to recall [them]. ... Lieutenant Williams is at present lent from his corps to the Pioneers, with whom his services are highly necessary in the operations in Cotiote[4]. This last officer is now the only one remaining of the six [443]"[5].

Williams himself writes; "On my entering the service in the year 1798, I was examined as to my qualifications for the Engineers and was attached with four other infantry cadets[6] to that corps; on a reference, however, to the Honourable the Court of Directors, they were pleased to determine that two only out of the five officers should remain permanently in the Engineers, and I was one of the two to whom the option was given of being fixed in that corps. Circumstances, however, had in the meantime occurred which induced me to prefer the Infantry[7], to which I now belong; the great part of the time that I was in the Engineers, I acted as adjutant to the corps, and all the time as a draftsman.

"In June or July 1800, while on service in the Province of Malabar [I, 132], I was appointed a Surveyor on the recommendation of Colonel the Honorable Arthur Wellesley (now Duke of Wellington). I was soon after put in charge of guides and intelligence on the same service, and also succeeded to the Command of the Pioneer corps[8], which in such a country it was found necessary to augment to about 1200 men. The duties of it were naturally important; at least the discharge of them fortunately met the appreciation of Colonel the Honorable Arthur Wellesley, Colonel Stevenson, and the other officers who commanded in those Provinces at that period"[9].

1798–1801, whilst attd. to Pioneers, "employed on the Roads and Passes", asstg. Moncrieff in surv'g. and mapping N. Malabar [I, 132], and attracting Wellesley's notice on several occasions[10]. Held comd. of Pioneers from 1801 [337–8].

15–3–02, Wellesley notes receipt of "a very interesting report by Lt. Williams upon the subject of the road which I desired some time ago might be made round Mahè"[11]. With this report was a sketch of French territory at Mahè, near Tellicherry, with history of French claim's; *v.* MRIO. Misc. 3 & 4–0–02, with copies and reductions from original, scale of 650 toises to 2 inches.

[1] DDn. 131 (157). [2] Fdbk. MRIO. M 541; DDn. 162. [3] Bo MC. 16–11–1798. [4] Kottayam, N. Malabar [I, 132 n.3]. [5] Bo MC. 6–3–01 [6] One being Sutherland [443]. [7] viz., his appt. to comd. Pioneers. [8] Succg. Moncrieff [I, 356–7]. [9] Bo MC. 8–5–15. [10] *Supply Desps.* III, 15–3–02; 9–1–03. [11] ib. 29–6–02.

At Reynolds' request, appd. Asst. to the SG. at Surat "without prejudice, however, to his situation in the Pioneer Corps, to which he will return as soon as the Surveyor General can dispense with his services"[1] [282 n.7, 323].

Appd. Dep. to SG., and on Reynolds' strong recdn. succd. him 2–3–07 [305–6, 323, 325]. Dec. 1807, survd. route Sirūr[2] to Poona, and thence to Borghāt near Khandala[3]. 1809–10, conducted svy. of Gujarāt [170–3, 338]; spent much of his time as SG. in completing and adding to Reynolds' great map [7, 283–5, 287].

April to June 1811; examining teak forests on Narbada [168]. 1811–6, on rev. svy. of Broach, working out procedure with collr. of district; svy. on these lines being later extended through Gujarāt [8, 188–9, 323, 338, 363].

On abolition of post of SG. Bombay, 20–2–15 [306], Williams submitted claim to be made SG. of India with lengthy memorial setting out his long services as survr.,[4] but there was never any doubt that the appt. must fall to Mackenzie [306–7, 427].

Continued on svy. duty for the rest of his service.

WILLISON, David. Mad. Inf.

b. 2–2–1776. d. 10–7–06, kd. in Vellore mutiny [135 n.4].

Ens. 7–9–1797 ... Capt. 7–7–05.

Son of David Willison, printer of Edinburgh, and Jean Bruce his wife.

1804, survd. route Hyderābād to Kotah.

WILSON, William Owen. HM. 22nd Foot.

Lieut. 2–9–1795; Capt. 13–9–06.

1803, survd. route of his batt. from Calcutta to join Grand Army[5] [27].

WILTON, George. Ben. Engrs.

b. 4–5–1794.

d. 24–4–17, Rangpur, Bengal.

Ens. 7–12–12.

Son of Rev. Wiliam Joseph Wilton, of Newcastle-on-Tyne, and Mary his wife.

ed. Addiscombe 1810.

Hodson, IV (500).

1812, survd. Bhāgīrathi R. from Sooty[6] to Mohanganj, with "plan of the ground in the vicinity of the proposed communication between the Ganges and Bhagirutee" [21], "which appears to have been carefully and correctly made"[7] [312].

BGO. 2–9–15, appd. to construct new powder magazine at Ishāpore.

ib. 15–11–16, appd. "to Survey Rungpore frontier east of Brahmaputra River, and such part of the Garo Hills[7] as may be accessible"; died before any svy. was completed.

WOOD, Thomas [I, 398–400]. Ben. Engrs.

b. June 1765. d. 22–1–1834, Calcutta.

Ens. 18–5–1785 ... Col. 25–6–30.

Son of Robert and Anne Wood; 1st cousin to Mark Wood, SG. 1786–8 [I, 397–8].

m., Calcutta, 30–10–27, Miss Elizabeth Pierce. In will of 1831 mentions 6 children without indicating their mother, or mothers.

CB. 1815. Hodson, IV (516–7).

1792–4, survd. Brahmaputra R. during Welsh's campaign in Assam [I, 80–2]; 1795–6, survd. Irrawaddy R. during Symes' embassy to Ava [I, 84–5]; From 1798, Survr. with army in Oudh [I, 57–9; II, 12], his most notable svy. being a line from Cawnpore through Lucknow and Pīlībhīt to Hardwār, and then down to Cawnpore by river [I, 58; II, 36–7, 268]. In 1828 a copy of the section between Cawnpore and Fatehgarh was sent up to Boileau, on svy. in that area, who refers to it as "that beautiful little survey"[8]. In fact, all Wood's finished surveys were most beautifully drawn in colours [pl. 5][9].

1801–2, survd. Ganges between Cawnpore and Allāhābād, where under the new treaty it formed the S. boundary of Oudh [22, 26]; Feb. 1802, received orders from the GG. to svy. the Nawāb's W. Boundary[10] [30–34, 268–9 309].

Disgusted by delay in paying his allces. he wrote to SG., 3–5–02, "I thank you most kindly for your assurance that you will not mention me as a surveyor without my entire concurrence, and, as you never will have that, I find myself much relieved on that subject; for I do assure you, I would rather be on my half-batta, than on survey allowances, and suffer in the manner I have done for these two years and a half past[11] [I, 400; II, 326–7].

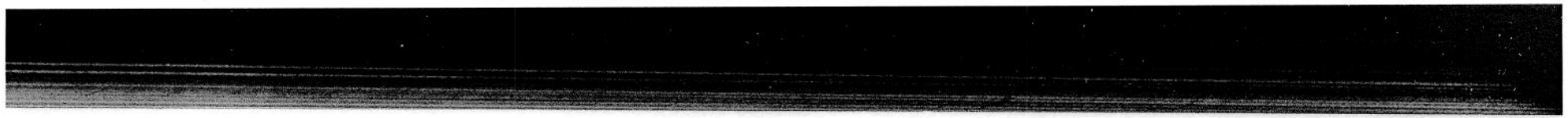
He completed his svy. of the boundary by August; "To protract the latter part, and afterwards to furnish your office with two fair copies of the whole, as required by the Regulations, ... will still be the work of several months. For that reason, and under the idea that more surveys are to be carried on in this part of the country [27], I take the liberty of suggesting that some other officer may be ordered on this duty. ... During my late surveys I have suffered not a little in my health and, I beg you will submit...my most humble and earnest entreaty to be relieved from this duty"[12].

His request was granted, and he was relieved, 23–9–02, and appd. to comd. the newly raised corps of Pioneers from 18–8–03; served through the Marātha War, distinguishing himself as CE. with Lake's army at siege of Bharatpur and elsewhere [222, 385]. Mentioned in despatches on several occasions, eg., after the capture of Gwalior, 5–2–04.

1805 till death on engr. duties [385].

On Mackenzie's death in 1821, held ch. of SG.'s dept. from 8th to 24th May, until relieved by Hodgson. Became CE., Ft. William, 1830, holding post till death. Owned property round Wood St., Calcutta, which took his name [I, 400].

[1] BoGO. 7–1–03. [2] 47 J/5. [3] 47 F/5, the pass through which road and railway between Bombay & Poona cross W. Ghāts, *Imp Gaz.* IX (5). [4] Petition of 3–2–15; BoMC. 8–5–15. [5] 78 D/2. [6] DDn .128 (117, 149), 14–12–12 & 203 (95), 10–10–28. [7] 78 K. [8] MRIO. M 348, 14–4–28. [9] see MRIO 31 [27–8, 71, 77–80]; Misc. 1–0–1797, etc. [10] DDn. 67 (70). [11] DDn. 15 (247). [12] ib. (259), 31–8–02.



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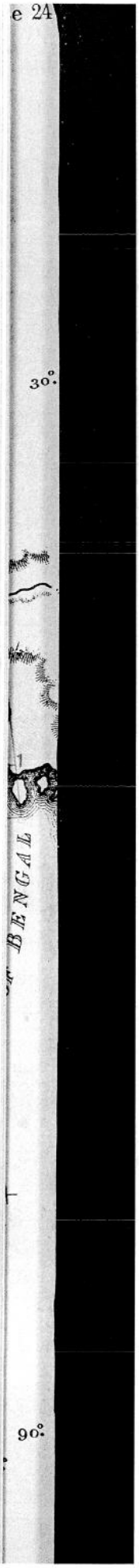
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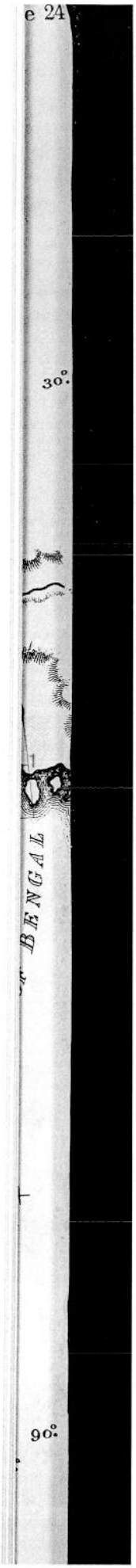
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Geographical Sketch,

OF MILITARY OPERATIONS IN INDIA FROM 1803 TO 1806.

Thorn's map shows Attock 2° too far south. Nerbudda R. is shown continuous with Son, being reputed to rise from same source. [1,30]. Southward bend of Kistnah R. omitted at position of name.

Deliberate surveys before 1800 . . .
Reliable surveys 1800-15 . . . . . .
Less reliable surveys 1800-15 . . . .

For earlier surveys, see plate 21, Vol. I

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India. Survey of India Dept.
Historical records of the Survey of India.

TIBET
NEPAUL
BENGAL
BENARES
CALCUTTA
BOMBAY
MADRAS
SERINGAPATAM
CIRCARS
ORISSA
COROMANDEL COAST
BAY OF BENGAL
MALABAR COAST
Cashmere
Attock
Moultan
Indus R.
Great Sandy Desert
Puddar R.
Amedabad
Cambay
Gulph of Cambay
Diu
Surat
Lucknow
Patna
Ganges R.
Brampooter R.
Rotas
Ballasore
Cuttack
Jagarnaut
Ganjam
Vizagapatam
Mangalore
Tellicherry
Calicut
Cochin
Tritchinopoly
Tanjore
Negapatam
Tranquebar
Pondicherry
Anjengo
Delhi
Agra
Jaipur
Jodhpur
Ajmere
Gwalior
Bhopal
Nagpur
Hyderabad
Mysore
Travancore

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From MAP OF HINDUSTAUN
Charles Reynolds, 1808



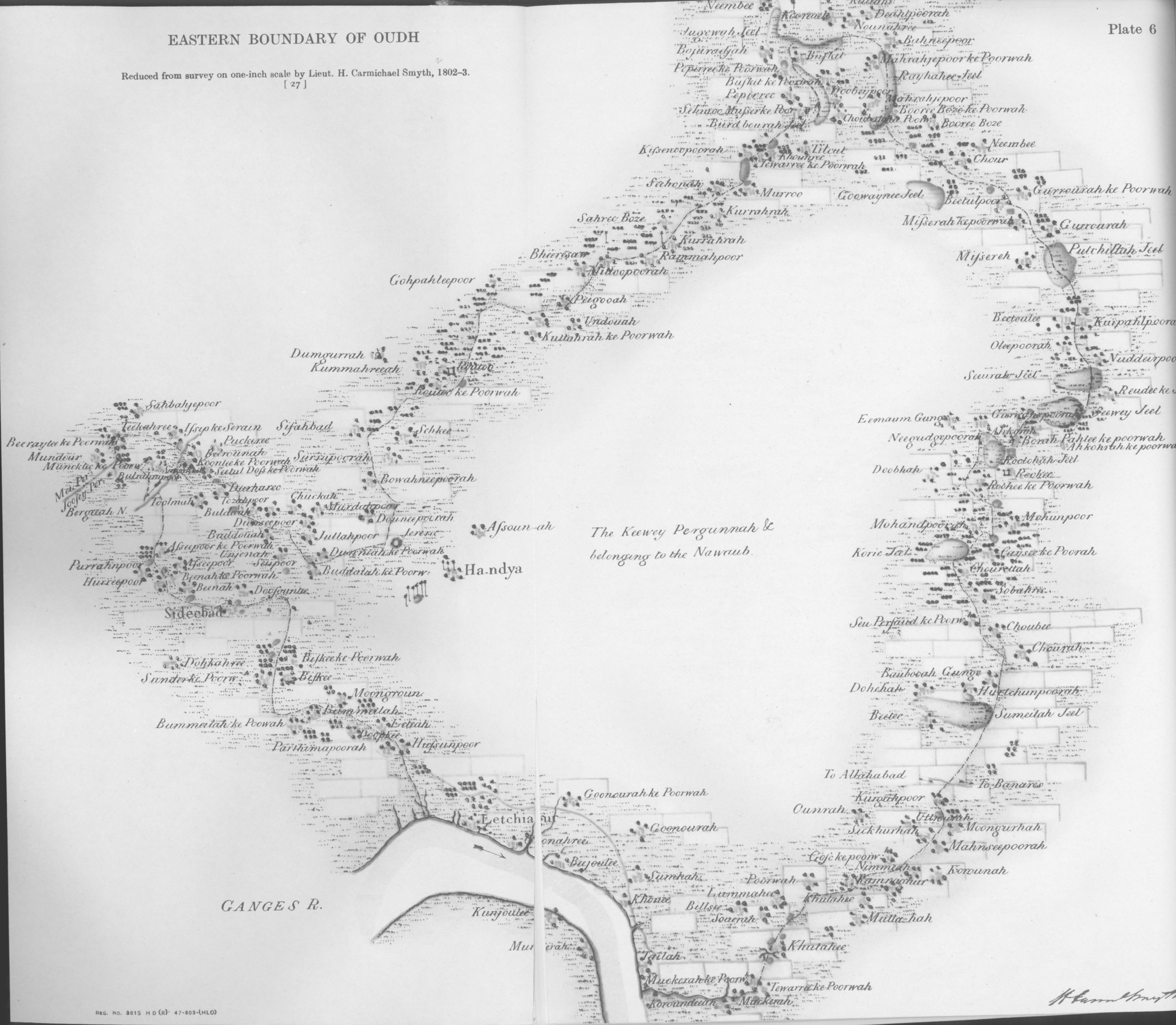
Reduced from sheet No. 20 of Reynolds' map, scale 9 inches to one degree [p. 282–5].

Compare plate 6. Volume I.

REG. No. 3812 M D (R)

EASTERN BOUNDARY OF OUDH

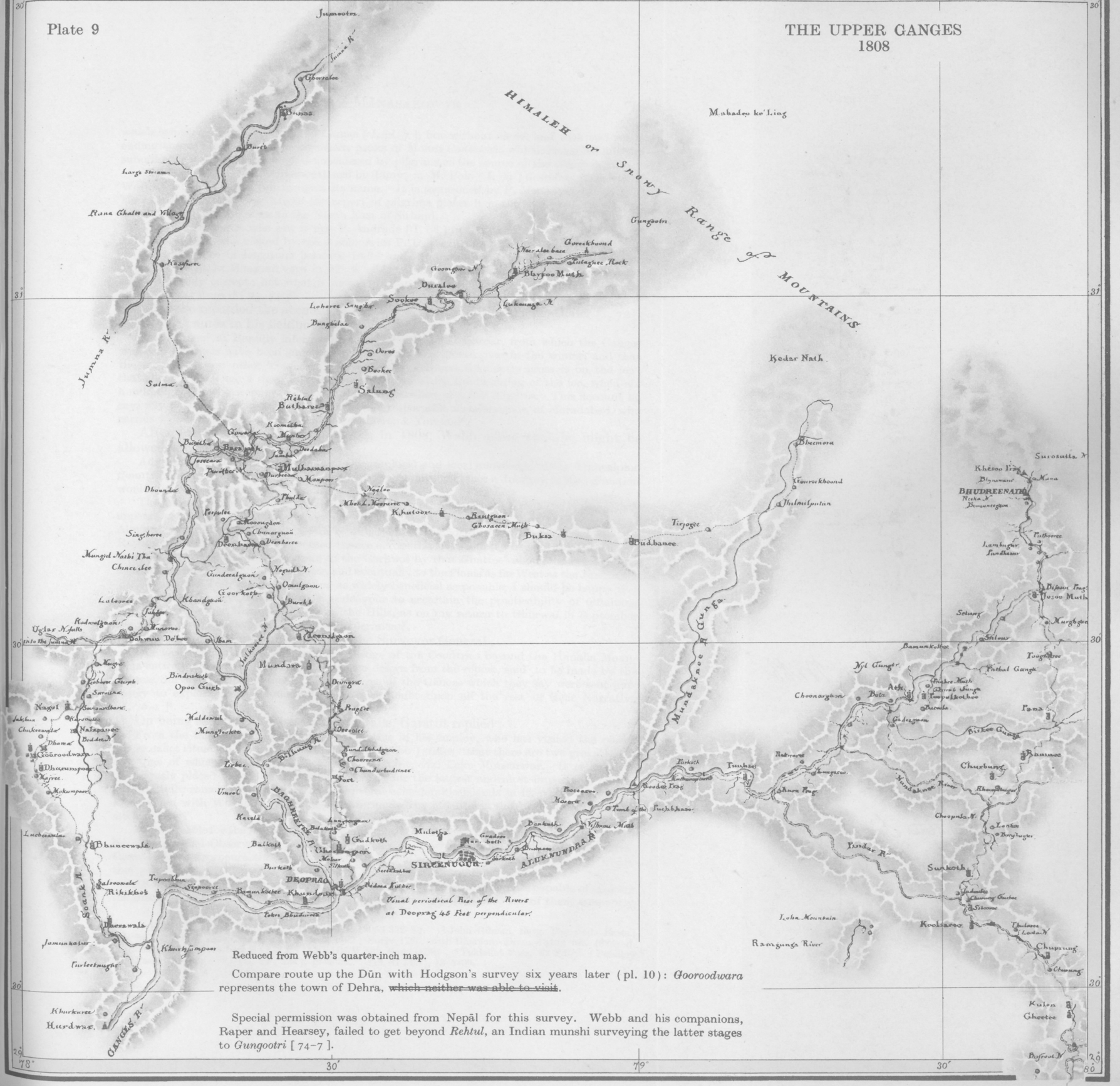
Reduced from survey on one-inch scale by Lieut. H. Carmichael Smyth, 1802–3.
[27]



REG. NO. 3815 H D (R)' 47-803-(HLO)

Plate 9

THE UPPER GANGES
1808



Reduced from Webb's quarter-inch map.

Compare route up the Dūn with Hodgson's survey six years later (pl. 10): *Gooroodwara* represents the town of Dehra, ~~which neither was able to visit~~.

Special permission was obtained from Nepāl for this survey. Webb and his companions, Raper and Hearsey, failed to get beyond *Rehtul*, an Indian munshi surveying the latter stages to *Gungootri* [74–7].

See extension on reverse

MAP
of the
SEHARUNPOUR FRONTIER
with Parts of the
Adjoining Provinces
of
Gurwal & Sirmour
by
Captain H. H. Hodgson. Surveyor. 1815

Deodara

Snowy RANGE

Ranges of Mountains

Baradsuh Dt

Lohon Dt

Jutrou Dt

Agalta Dt

Jaksamy Dist!

Temple Chearry highest of Bearguldeori Black Mountain, Crowned with Snow, till the Month of June

Extended Course of the Tonse R.

Mt. Lohan-Kanda Iron Mines

GURWAL

Jumna R.

Judakotmpa-Sangs.

Bagheratti R.

Bysothi

Bowahant

Dannela

Joanga

Phalda

Continued ranges

Musagony

Dubrie

Singpe

Murgulton

Umlgang

Deorah

Mount

Dist!

Lalouag

Manora

Bowangedeori

Doonga

Sragi

Dauk

Gundachalgun

Nagmaserai

Chamoli

Lungasongong

Baleat

Alacananda R

SRINUGGUR

Solecotha

Budderathi

Gunga R.

Rajah Kot

Budapur

Pitchoes

Jungelia

Lucherghaut Ferry

Deorawalla

Sirkhawala

Sirkote

Bogpour

Batchiwala

Chumpaw

Thanno

Brumtpodie

Kotsum

Sudrapour

Sunpoor

Kote

Nimmedeo

Kunkul

Chandnee Pkh

Dooltalpour

Chuatapour

Belry

Rampur

Kalsy

Vatsary

Hurrawala

Jemmawala

Kalsee Ghur

Burkhpour

Dehry

Sumpowala

Totawala

Timly

Timly Pass

Bugmapour

Stagid

Samadara erdstspring Path

Rohunga Ft

Datumwala

Mollywallia

Cody

Dunkwala

Majra

Dugmapour

Ikapour

Ferry

Fidakamala

Fyzabad

Sarapour

Neserai

Nolanpour

Jotumwala

Nonegong

Manowly

Mungery

Sherkpoorie

Ramsipour

Cheanly

Bait

Jeelypour

Kaad

Jaundra

Sewanpur

Jongdra

Bobail

Kelsi

Kelspoor

Kerie

Kerie Pass

Mosaid

Sultanpur

Budeshera

Chilkanni

Sulberie

Mehesry

Nigrospoor

Bramly

Pilluny

Du tolly

Bogpour D'Sukery

Sherjehanpoor

Sersawar

Chapers

Meerpoor

Vatsaura

Bulaspour

Chalie

Gurnoula

Gurnardy

Chicherowly

Mandkery

Ballarchoor

Jaidua

Hudry

Kanwun

Dadoopoure

Booky

Bogpour

Bulhera

Tatta

Barra R.

Mowarikpoore

Beerpour

Dooregana

Nuneera

Sultanpur

Budeshera

Sulberie

Chapers

Meerpoor

Mehesry

Nigrospoor

Bramly

Pilluny

Du tolly

Bogpour D'Sukery

Sherjehanpoor

Sersawar

Vatsaura

Kelspoor

Rajpoor

Chandy

Rahmudpoor Hurrawa

Mukarlaca

Banarpoor

Hurgpra

Cotchaw Sagar

Mudjpra

Beree

Hurdy

Kytrag

Boodly

Bolotie Gograkey

Rendey

Sherkpoora

Koolby

Manickmora

Bellcah

Jeenghary

Dingdee

Seroolly

Kedarghur

Kera

Jodpra

Chapra

Chowdy

Mulpour

Lucrmun

Serechunty

Rielpoor

Chundeela

Banarsy

Pimpur

Rohutty

Sallie

Nimkur

Rampur

Belry

Hurdwar

Hur ki Pairee

Hurdwar Pass

Ganges Canal

Mohun Ghat Ft

Mohun Ghat Pass

Ganges R.

Mohun Ghat

Ramgunga R.

Ramgunga

Kaleenuddy R.

Kaleenuddy

Kaleenuddy Pass

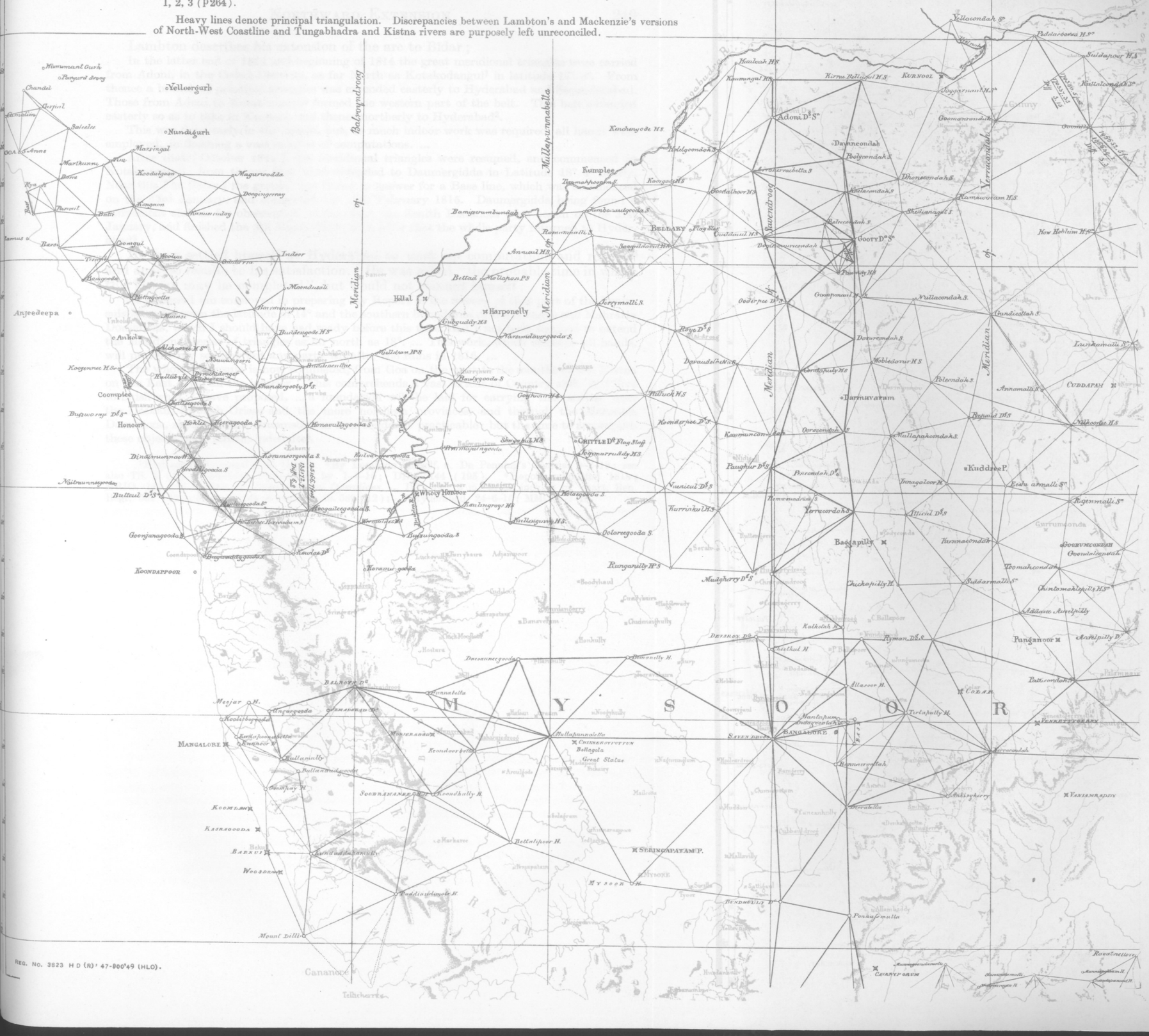
Plate 16

LAMBTON'S NORTHERN TRIANGLES

Map reduced from Mackenzie's maps of 1808.

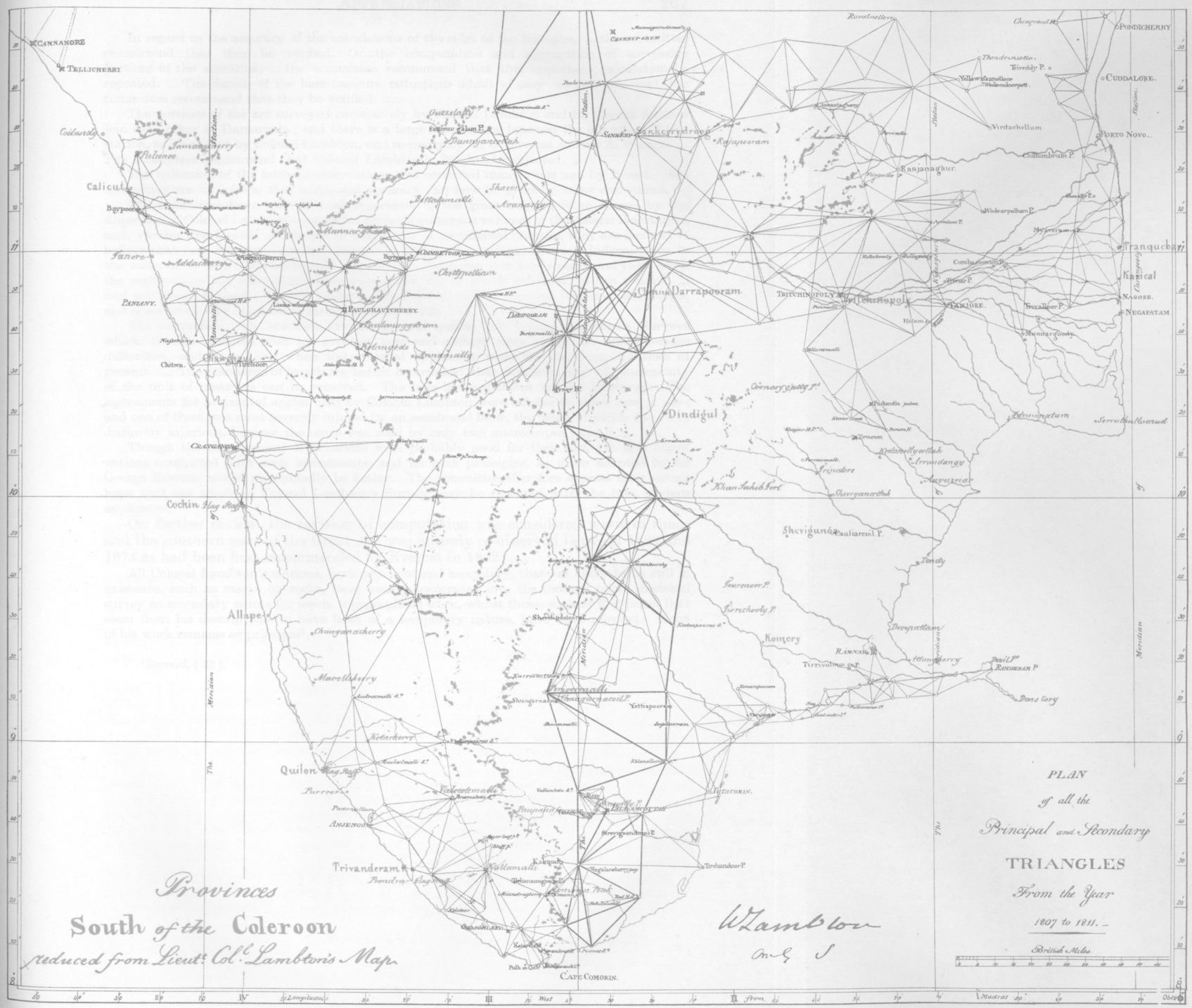
Lambton's triangles reduced from M.S. charts contained in Trigonometrical Survey M.S. Volumes 1, 2, 3 (P264).

Heavy lines denote principal triangulation. Discrepancies between Lambton's and Mackenzie's versions of North-West Coastline and Tungabhadra and Kistna rivers are purposely left unreconciled.



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LAMBTON'S GENERAL SURVEY
OF
SOUTH PENINSULA



Reduced from Lambton's 8-mile *Plan of the Southern Provinces*, completed in 1811 (244, 277) with his triangles surprinted from chart bound with MS. Report, TS. II, cf. *Complete Plan of Trigonometrical Operations* published by Jas. Horsburgh, 1827, in 8 sheets, scale 8 m. to inch (263–4).

Heavy lines denote principal triangulation.

REG. No. 3822 H D (R)1 47-800-(HLO)